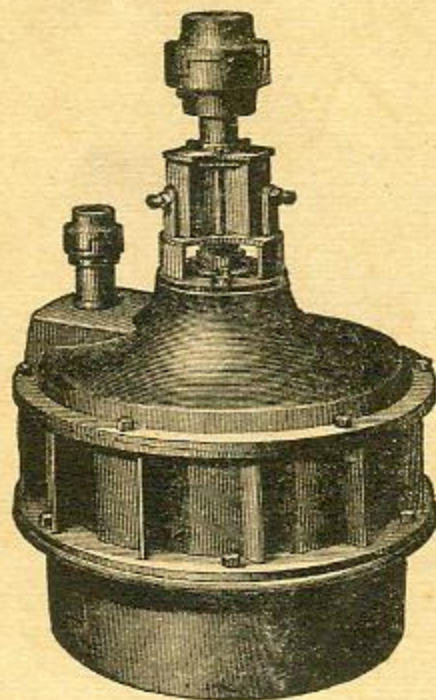


The BALANCED GATE
Turbine Water Wheel



CHRISTIANA MACHINE COMPANY,
CHRISTIANA, PA.

1895.

1011 26, 2648 MARKET ST., PHILA.

ILLUSTRATED AND DESCRIPTIVE

Pamphlet and Price Lists

OF THE

BALANCED GATE

Turbine Water Wheel.

PATENTED SEPTEMBER 3, 1889.

MANUFACTURED BY

CHRISTIANA MACHINE COMPANY,

CHRISTIANA, PENNA.

PREFACE.

IN ISSUING this edition of our *Water Wheel Catalogue*, we wish to say to those using water power or intending to do so, that the **Balanced Gate Water Wheel** has now been on the market and in use for five years and has given universal satisfaction.

We claim for it a place among *Wheels* of the first class, basing this claim upon results of tests made with it and the statements of those using it.

Aside from the importance of details of construction, we recognize two essential qualifications in a good wheel:—First, it must be well made and durable; and second, it must be economical in the use of water.

An accurate knowledge of and many years of experience in building this class of machinery enable us to meet the first condition, and that the second has also been secured is proven by the fact that our wheels, under all ordinary conditions, give in useful effect, more than 80 per cent of the power resident in the water used.

The distinguishing feature of the **Balanced Gate Turbine Wheel**, and from which is derived its name, is the patented device for moving the register gate. This and other good points will be found described in connection with the illustrations.

Eight different styles of wheels are illustrated and described in this catalogue—some on vertical, and others on horizontal shafts. While these fairly represent our general lines and from them may be selected a wheel or wheels suitable for almost any situation, we are prepared to make such modifications as may be required in special cases.

Particular attention is invited to our horizontal wheels, the designing of which has involved a great amount of careful study. We feel justified in believing that for compactness, simplicity and other good qualities they are unsurpassed by any wheels now made.

They are adapted for use in any case where the power is to be transmitted to a line shaft, either by coupling direct to the wheel shaft or by use of pulleys and belts or spur gearing, and are particularly suitable for electric light and power stations.

Electric transmission now makes it possible to utilize water powers that have heretofore been useless on account of their location. For developing such powers, we are enabled to meet all conceivable wants in the extensive range of sizes and variety of styles both of our vertical and horizontal wheels.

CHRISTIANA MACHINE COMPANY.

very important that the pit under the wheel should at least comply with the rules here laid down and its depth should not be less than that given in the table of measurements on page 17. Unless it has a rock bottom, it should be well lined with some material that will prevent washing and injury to foundations.

Draft Tubes.

It is often convenient, especially in using a wheel under a high head, to place it some distance above the tail water and use a draft tube.

All wheels on horizontal shafts require draft tubes of sufficient length to keep the pulleys or gears, on the shaft, well up above the highest rise of the tail water.

These tubes should be made of boiler iron and perfectly air-tight and secured to the case of the wheel with an air-tight joint. They can be safely used up to a length of ten to fifteen feet, but it is advisable to keep them as short as possible. The lower end should extend a few inches below the surface of standing tail water.

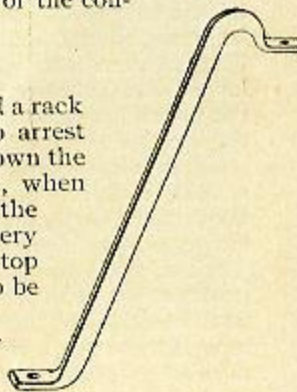
All of our regular vertical wheels are made with a short tube or cylinder, so that the lower timbers of the penstock may be kept just above the water. When greater length of tube is required a flange is made on the lower end of the cylinder to which it may be attached. For short additions the cylinder is made longer.

Provision is made on all our horizontal wheel cases for the attachment of a tube, and we are prepared to furnish draft tubes of any size or lengths required, or the connecting flange alone if wanted.

Rack in Forebay.

In the use of water wheels of any kind a rack should be placed across the forebay to arrest driftwood, etc., that is liable to come down the stream. We furnish, for this purpose, when ordered, iron bars of the form shown in the cut. A rack made of these bars is very easily cleaned as the curve at the top allows the rake, used for the purpose, to be drawn off without interference.

They should be placed as close together as a free passage of the water will allow. Iron bars are preferable to



wooden ones as they can be made much thinner, presenting less obstruction to the water. Care must be taken that the head is not allowed to fall off by the rack becoming clogged. A very good plan is to have a coarse rack above to catch the larger drift. This will make the necessary cleaning less frequent.

Measurement of Water.

In all cases where it is necessary to use water with economy the amount available, if not already known, should be ascertained by some one of the various methods used for that purpose.

Where large interests are at stake or the conditions make the problem difficult it is advisable to have the aid of some one well versed in hydraulics.

Measuring Small Streams by a Weir.

The best method of measuring small streams is by the use of a weir. This should be constructed as illustrated on page 7. Procure a board or plank of sufficient length to reach across the stream with its ends bedded in the banks. If it is of sufficient width cut a notch in it deep enough to pass all the water and long enough to reach about two-thirds across the stream. If it is too narrow for this make the notch by securing pieces to it at the ends with cleats. The bottom and ends of the notch should be beveled leaving the edge nearly sharp on the up-stream side. The bottom must be straight and placed level across the stream and not less than eight or ten inches above the level of the water on the lower side. Care must be taken to close all crevices below the board and at the ends so that all the water will pass over the crest of the weir.

To correctly measure the depth of the water a post E should be driven in the bed of the stream three or four feet above the board, and its top made level with the crest B as indicated by the dotted line D.

If the water rises above the crest and post before this level is secured, use two stakes of equal length, one on the post and the other on the crest, and drive the post down till the tops of these are level with each other. When the water has risen to its greatest height and all is passing over the weir,

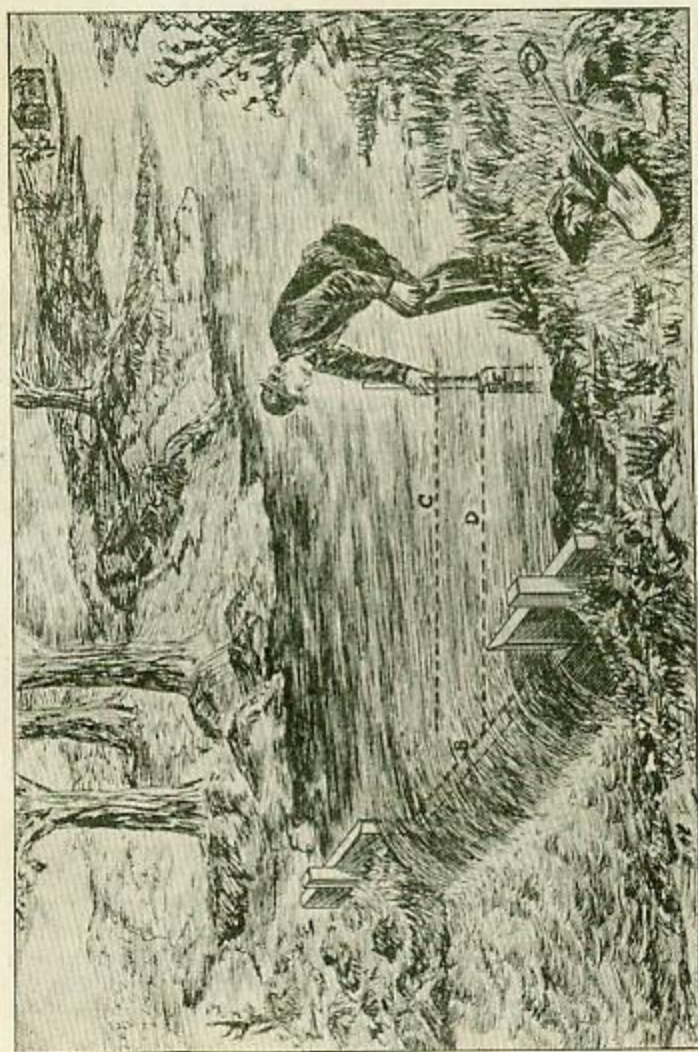


TABLE No. 1.

Giving Cubic Feet of Water per Minute, that will flow over a Weir
One Inch Wide and from $\frac{1}{8}$ to $24\frac{3}{4}$ Inches Deep.

INCHES.	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
0	.00	.01	.05	.09	.14	.19	.26
1	.40	.47	.55	.64	.73	.82	1.02
2	1.13	1.23	1.35	1.46	1.58	1.70	1.95
3	2.07	2.21	2.34	2.48	2.61	2.76	3.05
4	3.20	3.35	3.50	3.66	3.81	3.97	4.30
5	4.47	4.64	4.81	4.98	5.15	5.33	5.69
6	5.87	6.06	6.25	6.44	6.62	6.82	7.21
7	7.40	7.60	7.80	8.01	8.21	8.42	8.83
8	9.05	9.26	9.47	9.69	9.91	10.13	10.57
9	10.80	11.02	11.25	11.48	11.71	11.94	12.41
10	12.64	12.88	13.12	13.36	13.60	13.85	14.34
11	14.59	14.84	15.09	15.34	15.59	15.85	16.36
12	16.62	16.88	17.15	17.41	17.67	17.94	18.47
13	18.74	19.01	19.29	19.56	19.84	20.11	20.67
14	20.95	21.23	21.51	21.80	22.08	22.37	22.94
15	23.23	23.52	23.82	24.11	24.40	24.70	25.30
16	25.60	25.90	26.20	26.50	26.80	27.11	27.72
17	28.03	28.34	28.65	28.97	29.28	29.59	30.22
18	30.54	30.86	31.18	31.50	31.82	32.15	32.80
19	33.12	33.45	33.78	34.11	34.44	34.77	35.44
20	35.77	36.11	36.45	36.78	37.12	37.46	38.15
21	38.49	38.83	39.18	39.53	39.87	40.22	40.92
22	41.27	41.62	41.98	42.33	42.69	43.04	43.76
23	44.12	44.48	44.84	45.20	45.56	45.93	46.66
24	47.03	47.39	47.76	48.13	48.50	48.87	49.62

TABLE No. 2.

Giving the number of cubic feet of water discharged per minute by an orifice one inch square under any head of water from 3 to 72 inches

HEADS IN INCHES.	Cubic Feet Discharged per Minute.	HEADS IN INCHES.	Cubic Feet Discharged per Minute.
3	1.12	38	3.72
4	1.27	39	3.77
5	1.40	40	3.81
6	1.52	41	3.86
7	1.64	42	3.91
8	1.75	43	3.95
9	1.84	44	4.00
10	1.94	45	4.05
11	2.03	46	4.09
12	2.12	47	4.13
13	2.21	48	4.18
14	2.28	49	4.21
15	2.36	50	4.27
16	2.45	51	4.30
17	2.51	52	4.34
18	2.58	53	4.39
19	2.64	54	4.42
20	2.71	55	4.46
21	2.78	56	4.50
22	2.84	57	4.55
23	2.90	58	4.58
24	2.97	59	4.63
25	3.03	60	4.65
26	3.08	61	4.72
27	3.14	62	4.74
28	3.20	63	4.78
29	3.25	64	4.81
30	3.31	65	4.85
31	3.36	66	4.89
32	3.41	67	4.92
33	3.47	68	4.97
34	3.52	69	5.00
35	3.57	70	5.03
36	3.62	71	5.07
37	3.67	72	5.09

approximately correct purposes.

Select a portion of the stream that is nearest uniform in width and depth and free from short curves. Measure the depth at several equally distant points across the stream making the space between the bank on either side and the first point half as much as each of the other spaces. Add together all the depths taken and divide their sum by their number for the average depth. Multiply this result by the width and the product will be the area of the cross section in square feet.

Where an overshot or breast wheel is in use the amount of water used may be found by the following method: Determine by careful measurements the area of opening when the gate is raised to a working height, and the depth of the water in inches in the forebay, from the surface to the centre of the discharge opening.

Find in the annexed table the head corresponding to this depth and opposite it the number of cubic feet discharged per minute. Multiply this number by the number of inches in area of opening and the product will be the number of cubic feet of water used.

Measurement of Large Streams.

Frequently it is impracticable to construct a weir on account of the size of the stream. To measure the water in such cases a simple method is to ascertain the area of the cross section of the stream and multiply it by the mean velocity.

If correct data could be had the result would, of course, be absolutely correct. By observing the following suggestions, measurements may be taken that will be and sufficient for practical purposes.

Owing to the friction of the water on the bed of a stream the velocity is greatest at the surface and near the centre, and it has been determined by careful experiment that the mean velocity is about 80 per cent or four-fifths of that at the central surface. Bearing this in mind the average velocity may be estimated by throwing a body into the stream having nearly the same specific gravity or weight as the water. A block of heavy wood, that will sink nearly to a level with the water, will serve the purpose. Keep it near the middle of the stream and ascertain the rate of flow by noting the distance it passes in a definite time, and convert the distance and time into rate per minute. Take 80 per cent of this as the mean rate and multiply by the number of feet in the cross section as before found and the product will be the number of cubic feet flowing in the stream per minute.

Size of Wheel Required.

Having found the amount of water and the head under which the wheel will work, consult the tables on pages 34 to 39. At the top will be found the number of feet of head. Passing down the column find the number of cubic feet (C. F.) nearest to that of your stream and just above the amount of power (H. P.) to be obtained, and above, the revolutions (Rev.) per minute, while in the left hand column, opposite these, the size of the wheel is given.

COCHRANVILLE, PA., September 29, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The little 12-inch Wheel I bought of you is working splendidly. It runs my twenty-five barrel mill under twenty-four foot head with two-thirds gate.

Truly,

WILLIAM B. WILLIAMS.

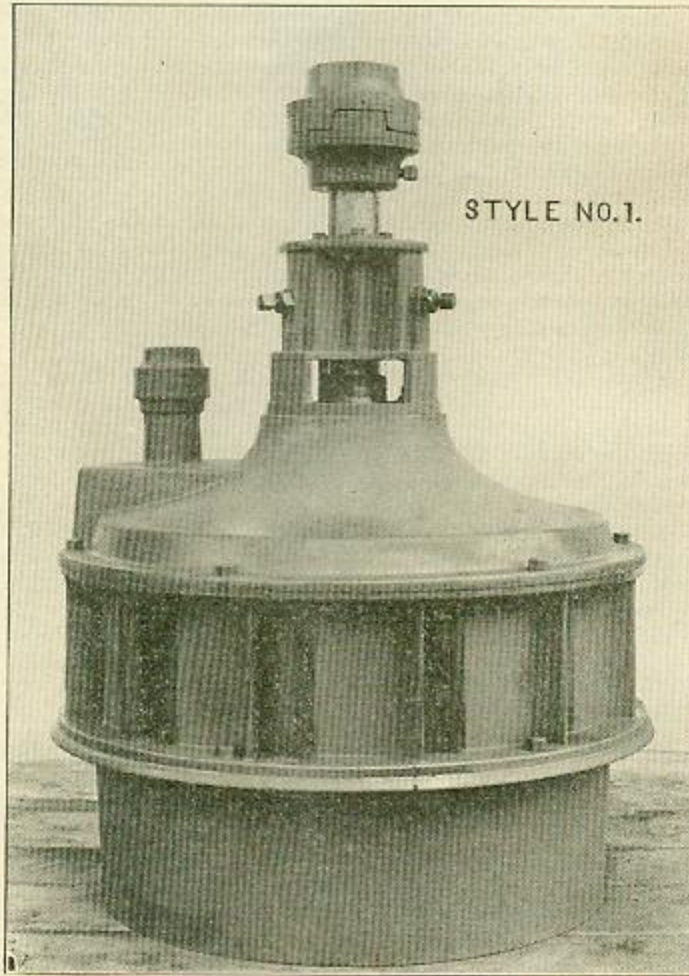
ZACK, VA., September 24, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Your card of recent date to hand. In regard to the 12-inch Turbine Wheel, bought of you some time ago, would say that the Wheel gives perfect satisfaction, and I think will do all you claim for it.

Very truly,

A. H. ZIMMERMAN.



STYLE NO.1.

STYLE No. 1.

The Balanced Gate Turbine Wheel

is superior to all other register gate wheels in that it is provided with a patented device whereby the power exerted to turn the gate is equally applied to its opposite sides, thus preventing all friction between curb and gate due to the side draft commonly used.

The mechanism is very simple and durable, and the construction is such that no possible amount of wear will impair its action. By its use, also, the wear is reduced to a minimum. Inspect cut on page 16.

It consists of but one moving part placed under the cap and so pivoted as to distribute the force as stated. It is operated by a short arm, with friction roller, attached to a stem passing through the cap, to which the hand wheel shaft is connected.

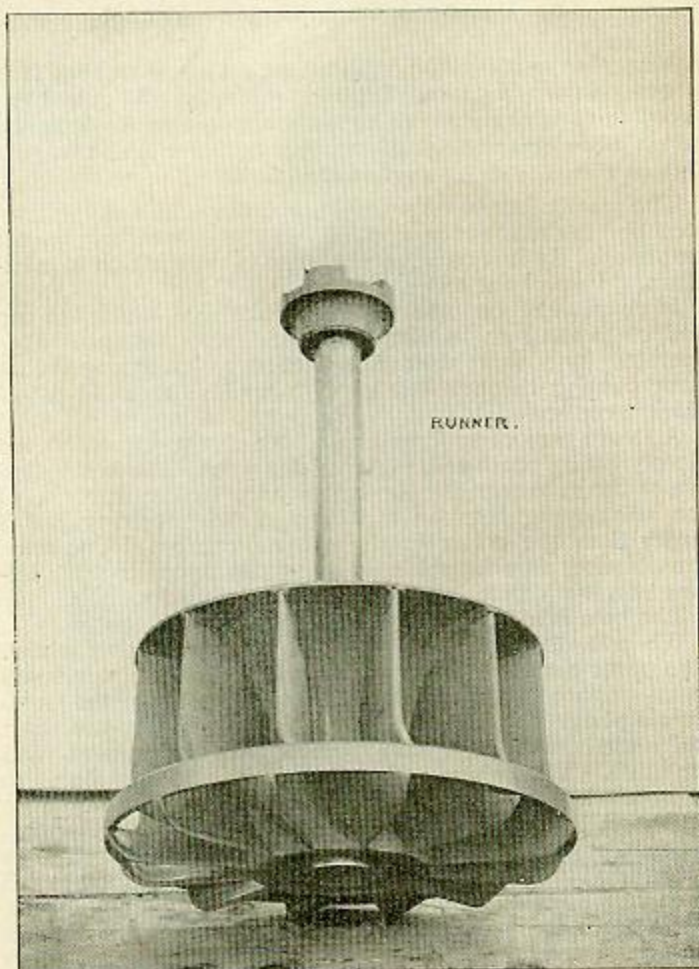
A sleeve projecting from the centre of the cap carries a closely fitting brass collar having flat sides. The hexagonal eye of the gate arm fits the collar only in the direction of the arms lying between the lugs of the gate ring, but is larger than the collar in the other direction. The arms thus having free lateral movement the opposite ends impinge on the lugs with equal force in moving the gate.

The gate is of the class known as the inside register.

We call attention to other good features of this wheel. The upper bearing consists of three brass followers enclosed in an elevated box. Under this and in place of the usual packing-box, is a deep brass ring closely fitting the shaft and seated on the cap, having freedom of adjustment with the shaft. Thus there is but little wear and it is found to be much better than a packing-box that is liable to be neglected. There is less waste of water.

Brass, or compound metallic bearings, when immersed in water, as is the case with the followers, used here, are found to be very durable.

We use a short draft tube (cylinder on wheel case), as in most instances it is desirable to place the supporting timbers a little above the tail water. Special lengths of these cylinders or independent draft tubes with flange connection are furnished when required. For prices of Style No. 1, see List No. 1, on page 42.



The Runner.

The hub of the runner is of the concave or bell-shaped type. The water acting against it has a lifting tendency and relieves the step of a part of the weight of the wheel, shafting, etc., that it carries. With the friction thus reduced the wear on the step is very slight.

There are no bolts or screws used to connect the blades to the hub, as the former are made with a dove-tailed edge where they meet the latter, and a set of them being placed in the mould, the hub is cast with ribs enclosing the edges of the blades, thus making what is equivalent to a solid casting.

A strong wrought iron band is then shrunk on the lower portion of the wheel, binding all the blades together and making a very strong wheel. It is then turned true and balanced. The lower part, with band, is larger than the upper part, and when placed in position, extends out under the surrounding gate ring; the band being thus protected from the downward current of water, foreign substances such as grass and leaves cannot lodge thereon and cause an obstruction.

This form of wheel adds to its capacity for a given diameter. The true diameter as listed is that of the upper portion.

PITTSBURG, PA., May 12, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The Water Wheel you sent me for Morton & Woodfall's Mill is doing nicely. It has power enough to make one and one half barrels of flour per hour, and drive all the machinery with less than two-thirds gate. The head is not quite ten foot, size of Wheel twenty-seven inches.

Truly yours,

C. T. HANNA.

MANDA, PA., March 21, 1891.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Replying to your inquiry about two Balanced Gate Turbine Wheels, recently purchased from you, would say I am perfectly satisfied with them. We use a little more water for them than we did with the overshot, but do double the amount of work.

Yours very truly,

BENJAMIN KRAMER.

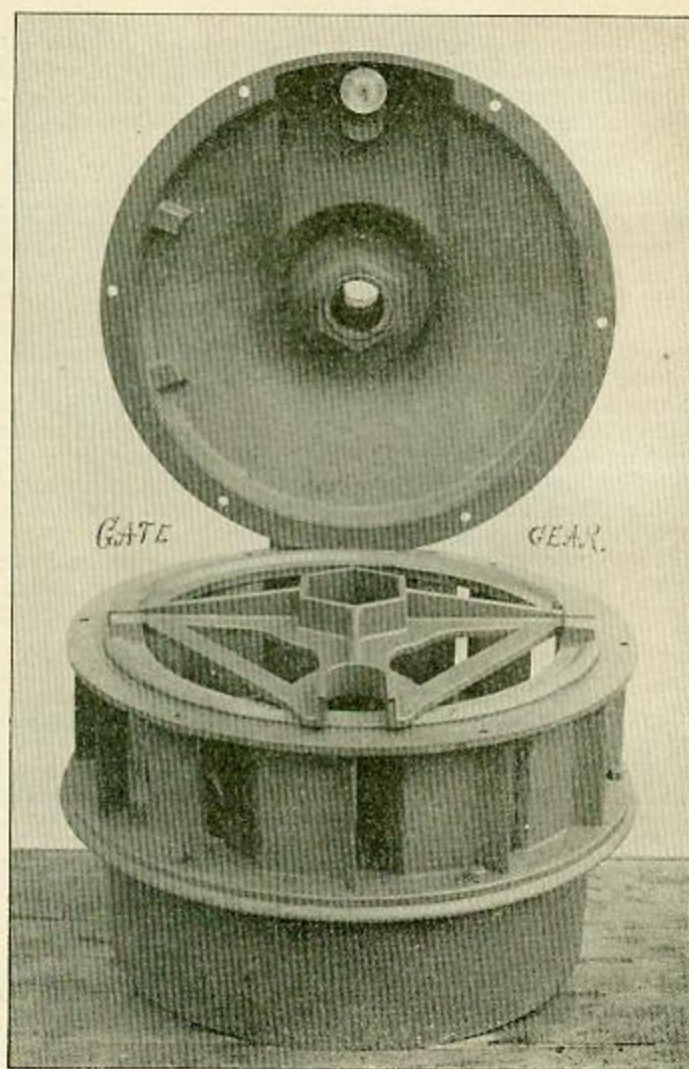
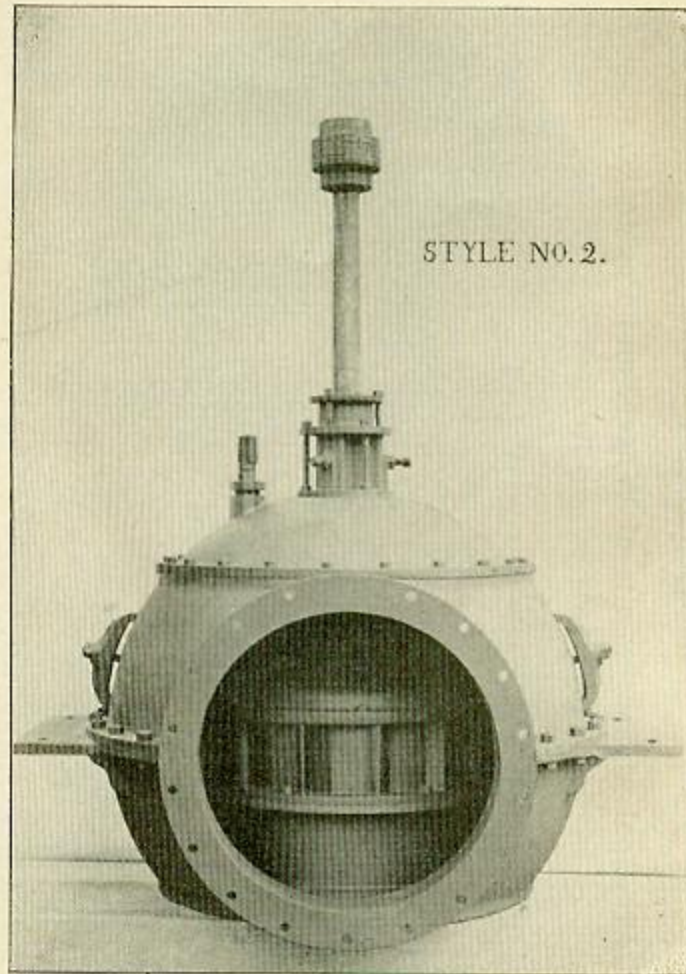


TABLE No. 3.
Principal Measurements of Wheels and Penstocks.
All Dimensions are in Inches.

Size of Wheels.	Size of Penstocks, Inside.	Depth of Tailwater in Pit.	Diameter of Wheel Case Outside.	Diameter of Cylinder on Wheel Case.	Length of Wheel Shaft from Floor.	Bore of Wheel Shaft Coupling.	Length of Gate Shaft from Floor.	Bore of Gate Shaft Coupling.	Space between Centres of Wheel and Gate Shafts.
10	33	18	16	13	17 1/4	1 1/2	12	1	5
12	36	20	18	15 1/4	19 1/4	1 3/8	13 1/4	1	6
14	39	22	21	17 1/2	22	1 7/8	14 1/4	1 1/2	7
16	45	24	23 1/2	19 3/8	24 1/4	2 1/8	15 1/4	1 3/4	8
18	48	26	26	22 1/8	27 1/4	2 3/8	16 1/2	1 1/2	9
21	54	28	30	25 1/2	31	2 5/8	18 1/2	1 3/4	10 1/2
24	60	30	34	29	34 1/4	2 7/8	20	1 3/8	12
27	66	32	38	32 3/8	38 1/4	3 1/8	22	1 3/8	13 1/2
30	72	34	42	35 3/4	42 1/2	3 3/8	24 1/2	1 1/2	15
33	78	36	46	39	46	3 5/8	26	1 1/2	16 1/2
36	84	38	50	42 1/2	49	3 7/8	28	1 1/2	18
42	96	42	57 1/2	49 1/2	56 1/2	4 3/8	31 1/2	1 5/8	21
48	108	46	65 1/2	56 3/8	63	4 7/8	34 1/2	1 3/8	24
54	120	50	73 1/2	63 1/4	70 1/2	5 3/8	38 1/2	1 3/4	27
60	132	54	81	70	77 1/2	5 7/8	42 1/2	1 3/4	30
66	144	60	89	77	85	6 3/8	47	2	33
72	156	66	97	84	92	6 7/8	52	2	36



STYLE NO. 2.

STYLE No. 2.

Vertical Wheel in Globe Case.

(Wheel on Vertical Shaft.)

The cut on opposite page represents our vertical wheel in cast iron Globe Case. We make these cases for all sizes of wheels from the smallest up to and including 24-inch.

They are made with brackets by which they are supported on timbers or iron beams, leaving the pit clear of all obstructions. A draft tube may be attached if needed. A deck plate is provided at the top of the case covering an opening large enough to admit of putting the entire wheel in or taking it out without detaching the case from the supply pipe or side of the penstock and taking it apart at the central joint.

The shaft is made long enough, up to the coupling, to allow the cover to be lifted sufficiently to get at the wheel, for inspection, without removing the attached shafting.

This spherical form of case has the greatest strength possible for resisting the effects of internal pressure.

For prices see List No. 2 on page 43.

TABLE No. 4.

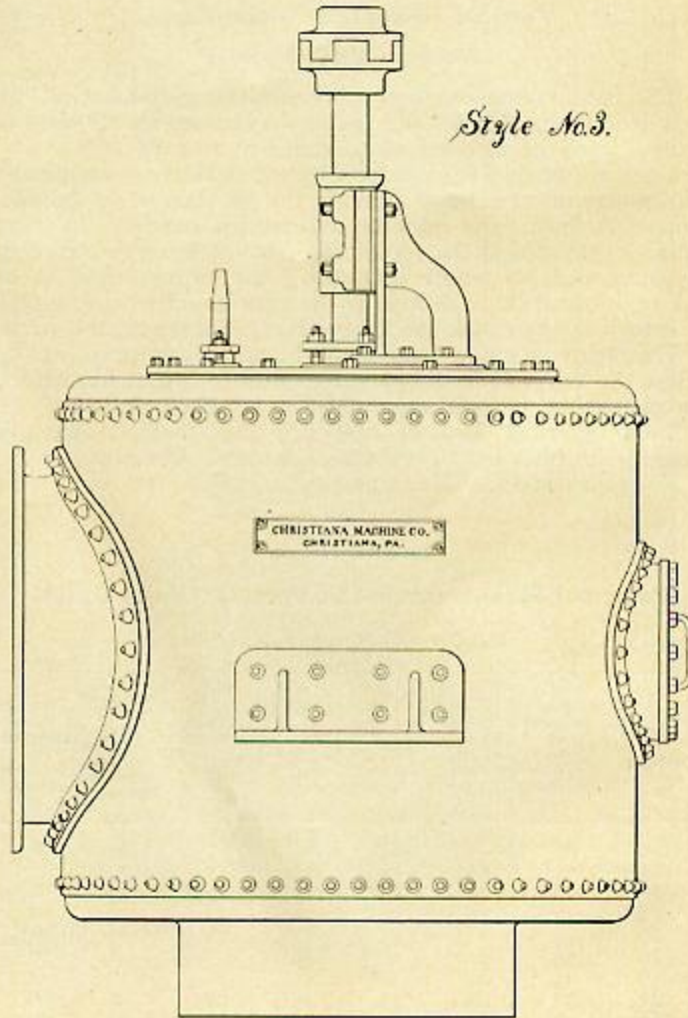
Principal Measurements of Vertical Globe Cases.

All Dimensions are in Inches.

SIZE OF WHEEL.	Diameter of Case or Distance between Supports.	Inside Diameter of Inlet Pipe.	Outside Diameter of Flange on Inlet Pipe.	Distance from Face of Flange to Centre of Shaft.	Inside Diameter of Draft Tube.	Length of Shaft from Bottom of Supporting Bracket.	Distance from Support to Bottom of Case.
6	21	9	14	11½	7½	29	6
8	24¼	10½	15½	13	9½	32	7
10	28	14	18½	14½	11½	35	8
12	33½	16	20¼	16¼	14	39	10
14	35	18½	23½	18	16	42	11½
16	39	21	26¼	19½	18	45	11½
18	45	24	30	24¼	20½	50	12
21	51	28	34	25½	24	55	16
24	57	32	39	27½	27	60	19

NOTE.—Bores of couplings of shafts and spaces between centres of wheel and gate shafts are the same as in Table No. 3, page 17.

Style No. 3.



STYLE No. 3.

Vertical Wheel in Cylinder Case.

This case is designed for wheels larger than 24 inches in diameter. The heads are made of cast iron and the sides of boiler plate. Like the globe case, it has supporting brackets, and a large opening in the top, for admitting the wheel, covered by a deck plate. A substantial bracket with lubricated bearing for upper end of shaft is mounted on top of the case. The interior is accessible through the manhole in the side.

We make this style of case, or any desirable modification of it, at a price to be given on application.

Principal dimensions furnished in advance when requested.

LONGDALE, VA., September 27, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 14-inch Balanced Gate Turbine, bought of you some time ago, is all you claim for it and more too. We are running it under an eighteen foot head, and can grind 125 bushels of good meal in twelve hours, and can saw 5000 feet of inch boards a day with the Salem Circular Saw, which we bought through you and have geared to the 14-inch Wheel. It does just as good work to-day as when we started it. When we saw, we run our head up to nineteen foot.

Yours truly,

M. W. KING.

PALMYRA, PA., March 7, 1890.

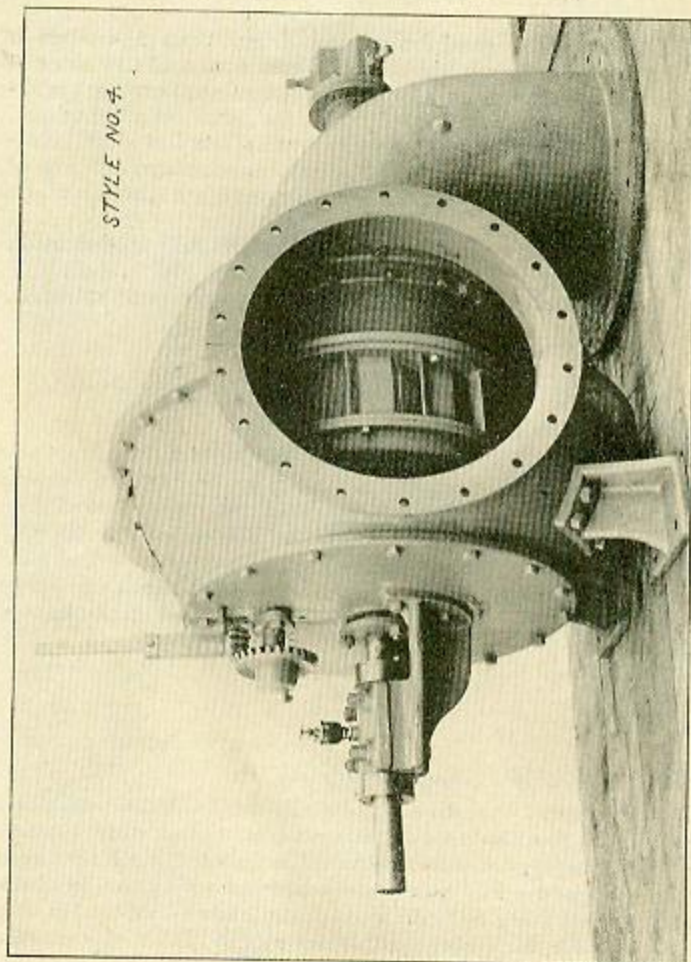
Christiana Machine Company, Christiana, Pa.

GENTLEMEN: I have had the 27-inch Balanced Gate Turbine Wheel you recently furnished to J. H. Hartman, in operation over a week, and it is doing a great deal more than I expected of it. I have been making one and a half barrels of flour per hour with two feet back water, and not using full gate, so at present its working head is only eight feet. Mr. H. is more than pleased with it. It not only runs the grinding and bolting machinery, but cleans the wheat at the same time, and I believe it gives more power than you claim for it.

Yours truly,

O. J. SEIBERT, Millwright.

STYLE NO. 4.



STYLE No. 4.

Horizontal Wheel in Globe Case.

(Wheel on Horizontal Shaft.)

The style of wheel shown on opposite page, and those that follow, are designed for all situations where it is required to connect by coupling to a line shaft or drive it by a belt from a pulley on the wheel shaft.

This case, like the vertical wheel cases, may be bolted to the side of a wooden penstock or to an iron supply pipe of suitable size, but for high heads we recommend the use of the iron pipe as being much more reliable.

The shaft of this wheel, as will be seen, has its main bearing in a bracket outside the case, where it can be lubricated by an automatic oiler or otherwise. The shaft is extended beyond the bearing to receive a pulley or coupling as may be desired. The opposite end of the shaft being provided with a suitable bearing, no other support is needed for light service. For heavy work, however, and where a large or wide-faced pulley is required, the shaft should be extended and have a bearing outside the pulley.

For prices of wheels as here shown see List No. 3 on page 43. Additional cost of pulley or coupling and outside bearing, if needed, given on application.

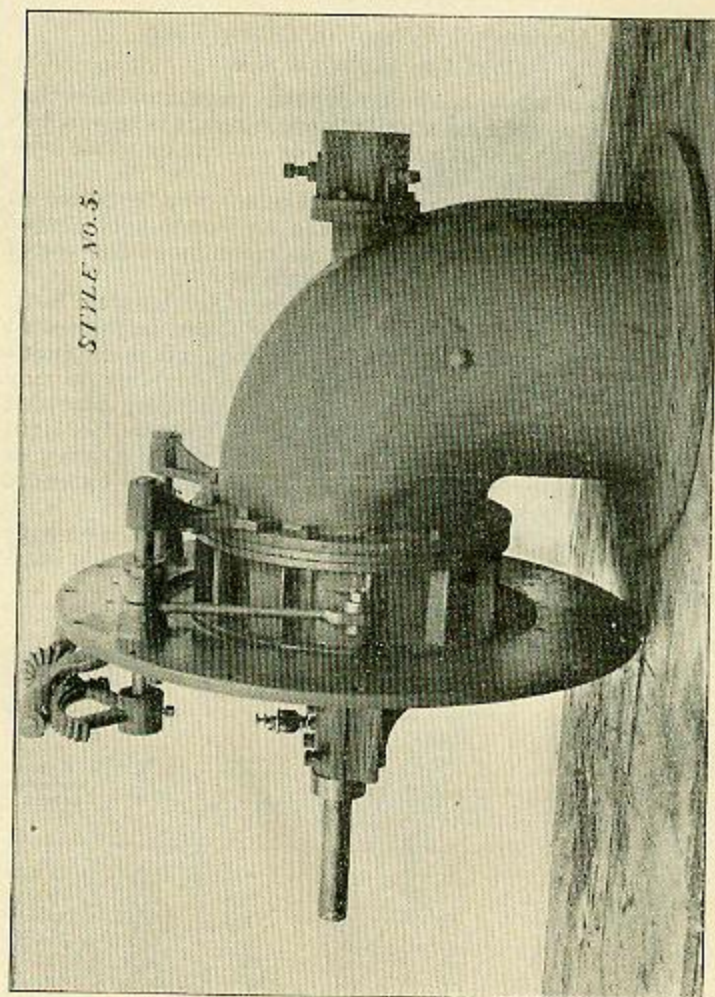
TABLE No. 5.

Principal Measurements of Horizontal Globe Case.

All Dimensions are in Inches.

SIZE OF WHEEL.	Height from Base to Centre of Inlet	Length from Centre of Inlet to End of Shaft	Length from Centre of Inlet to Centre of Discharge	Inside Diameter of Draft Tube.	Diameter of Shaft.	Floor Space Occupied. (About.)
6	11	21	14	7½	1½	22 x 38
8	13	24	16	9½	1½	26 x 44
10	15	27	19	11½	1½	30 x 50
12	17½	30	22	14	1½	35 x 56
14	19	33	24	16	1½	38 x 62
16	21	36	26	18	2½	42 x 67
18	24	40	29	20½	2½	48 x 74
21	27	46	34	24	2½	53 x 85
24	30	52	40	27	2½	58 x 98

NOTE.—For inside and outside diameters of inlet flanges and their distances from centre of wheel, see Table No. 4, page 19.



STYLE No. 5.

Horizontal Wheel for Wooden Penstock.

We give herewith a style of horizontal wheel the construction of which is so simple as to involve the least possible cost.

It is designed for use in a wooden penstock under low or moderate heads. It is to be placed inside the penstock with the connecting plate bolted to one side, in the same manner as in style number six, shown on pages 26 and 28.

Outside pedestal, pulleys, gears or couplings furnished as required.

Prices given on application.

INTERCOURSE, PA., July 14, 1894

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 30-inch Balanced Gate Turbine, which you shipped and placed in position for me, is doing the best of work, and gives entire satisfaction. I would not want a better wheel, nor do I think it possible to secure anything better.

I have worked with many wheels, but I prefer your wheel, and if I make any change in the wheels in my mill, it will be to use the Balanced Gate Turbine, as it will do the work where others fail in a low head.

Sincerely,

WM. FLICKENGER.

MIDDLETOWN, N. Y., August 6, 1894.

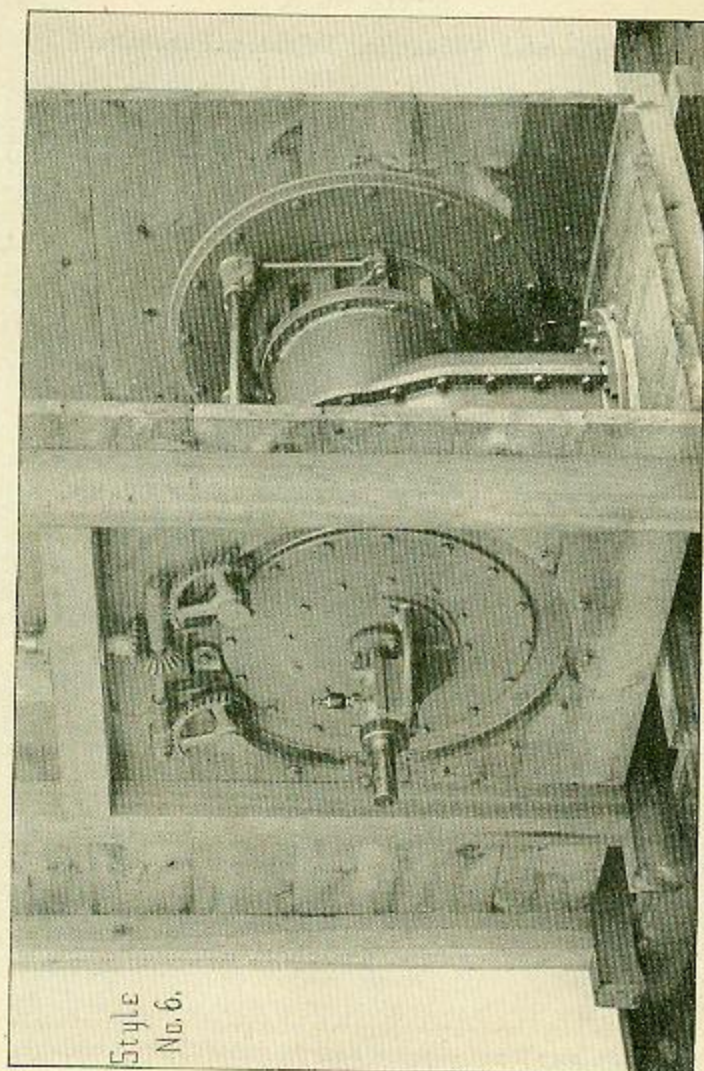
Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Replying to yours of the second instant, inquiring how the Turbine worked, will say, it affords me pleasure to state that both the 24-inch and 30-inch, bought of you, and put in under sixteen foot and twenty foot head, have given entire satisfaction after about one year's use. They are strongly built, well fitted up, and have a simple, yet strong and durable gate attachment which works easy and shuts tight.

In my twenty-two years experience with gears of different makes, yours have been found superior, both in smooth, quiet working and durability, to any others used.

Yours very truly,

D. G. COMINGS.



Style
No. 6.

STYLE No. 6.**Double Horizontal Wheels for Wooden Penstock.**

All our Double Horizontal Wheels, whether for wooden penstocks or iron cases, consist of a wheel placed at either end of a double, central discharge pipe. In this class of wheels, the movable register gate is outside. The inside ring, or curb is attached, by a projecting flange, to a corresponding flange on the end of the discharge pipe. The wheels within are mounted on a shaft that has its bearings outside but very close to the wheels. No inside bearings are used or required.

The illustrations of Style No. 6, show the manner of placing one of these machines within a wooden penstock and connecting it to the side planking. If a new penstock is to be built it should be made of proper width inside to suit the machine; but an old one, if large enough, may be altered to suit.

The location of the wheels just inside and close to the heads of the casing with the bearings of the shaft only sufficiently distant, outside, for the interposed packing-box, with room for its manipulation, constitutes a leading and important feature in all our Twin or Double Horizontal Wheels.

We thus secure the advantages of a short and rigid shaft, with all the merits of large amounts of power in the most condensed form.

Write for prices.

IN ORDERING state on which side the Gate Gear should be placed, considering the wheels to run from you at the top.

Directions for Setting Wheels in Wooden Penstocks.

In building a penstock use timbers for frame, floor and sides heavy in proportion to height of head and weight of wheel or wheels. Be sure that they are heavy enough and well put together with tight joints.

Have good foundation and place a few posts under the sills, if needed, for heavy wheels, to prevent sinking.

Frame bottom timbers so as to properly support the floor where the hole is cut for cylinder of wheel or draft tube.

For regular vertical wheel, Style No. 1, cut the hole in floor the size of cylinder, as given in Table No. 3, and for styles No. 5 and No. 6 to size of connecting flange on draft tube. Nail down a curbing of plank or boards around the hole and dress it true and level for a seat on which the wheel is to rest and place the wheel in position.

For Style No. 5, the penstock should be made about the same in size as for No. 1, and one side framed in the same manner as for No. 6.

For double wheels, of Style No. 6, the penstock should be a little wider than the length of the machine from out to out of the large flanges by which it is secured to the sides and the intervening spaces filled with segments of wood as seen in the cuts. The penstock should be about twice as large in the other direction.

All dimensions necessary for preparing penstocks will be given to those proposing to put in wheels of this kind.

The smaller sizes of these wheels, as in other styles, are shipped with all parts in place, but to provide for large ones, that may be received in parts, or for taking any of them apart for placing in position we give herewith full directions for erecting them within the penstock.

Pass the draft tube down through the hole in floor and rest it in position by supporting it below. Apply a heavy coat of thick paint to the face of flange to insure a water-tight joint. Place the discharge pipe in position on the curbing, prepared for it, with its ends parallel to sides of penstock, and bolt the draft tube to it, drawing bolts tight.

Mount the chute rings or curbs in their places on the ends of discharge pipe, noting that you are placing them to give the proper direction to the wheel, and then place the gate rings on the outside of chute rings. Next, bring the large head rings or connecting flanges into position, or nearly so, and the wheels being keyed to their proper places on the shaft insert them to their places with the head rings surrounding the shaft. Now, bolt the main heads to the chute rings and put the bracket bearings for the shaft in their places (if not already there). Bolt the large head rings to the main heads and if the former are in line with sides of penstock, the base may now be bolted to the floor, the spaces between the rings and side plank filled with soft wood segments, well fitted, and the rings bolted to the sides. If necessary, place the machine in line with machinery already set before putting in base bolts and fillers. Put gate shafts and connections in place being careful, in placing the worm shaft in position, to draw the segments into which they gear towards each other as far as possible in order to take up all lost motion. The rods connecting the gate rings to arms on gate shafts have an oblong hole at one end to prevent them from operating by a downward pressure, as they should turn the ring in either direction by an upward pull.

To take the wheels out at any time it is only necessary to remove one of the heads. The rings bolted to the side plank need not be disturbed.

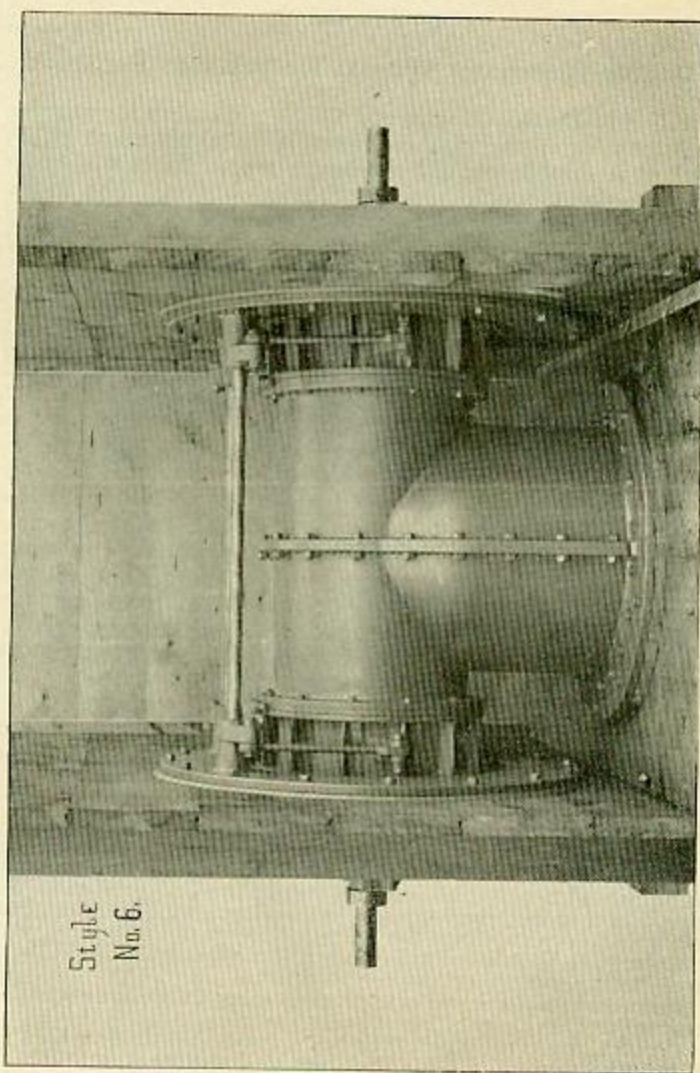
LYNCHBURG, VA., October 25, 1894.

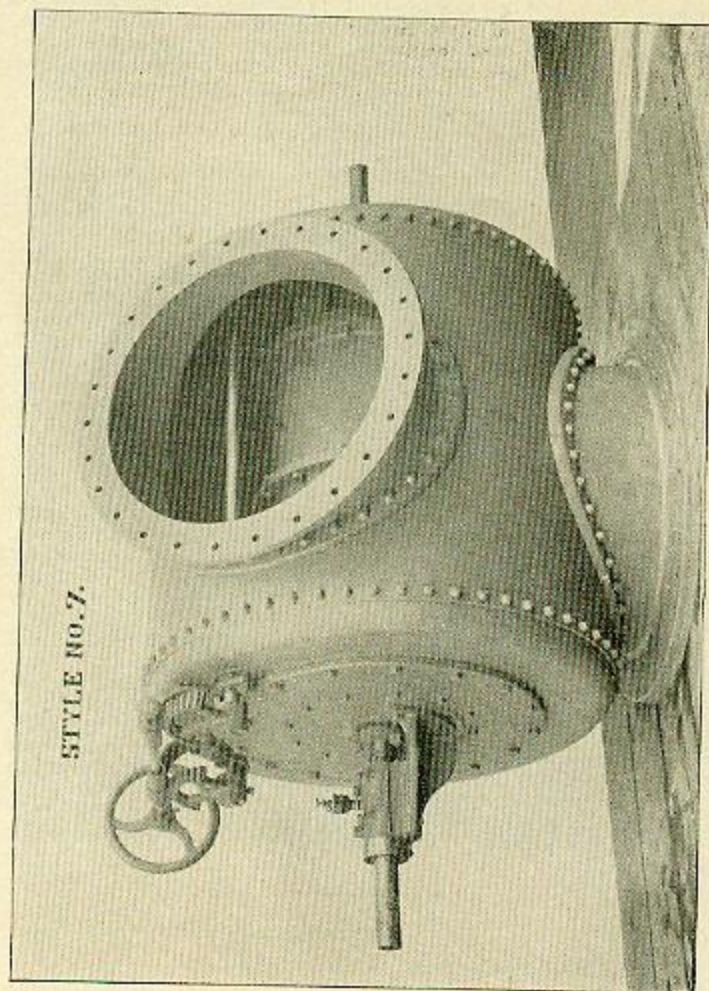
Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Replying to yours of the twenty-fourth instant, beg to say the 42-inch Wheel in question has given good service.

Yours truly,

JOHN P. PETTYJOHN & Co.





STYLE No. 7.

Double Horizontal Wheel in Iron Case.

We have endeavored to embody in this machine and style No. 8, the highest degree of excellence in turbine wheels.

The case is made of boiler plate with heavy cast iron heads, and is capable of sustaining the highest required pressure.

In each head is a circular opening large enough to admit wheel, curb and gate ring. A head plate covers this opening and is bolted to the main head and the curb within, the inner end of the latter being bolted to the central discharge pipe. By this means the heads are bound firmly together from end to end.

All joints are turned with shoulders to fix the parts true with each other, and on each head plate is mounted a bracket bearing for the shaft, having a half circle base resting in a corresponding seat turned true with the centre.

The bearings are provided with automatic oilers. As the end pressure of each wheel is neutralized by that of the other, they run with the least possible amount of friction.

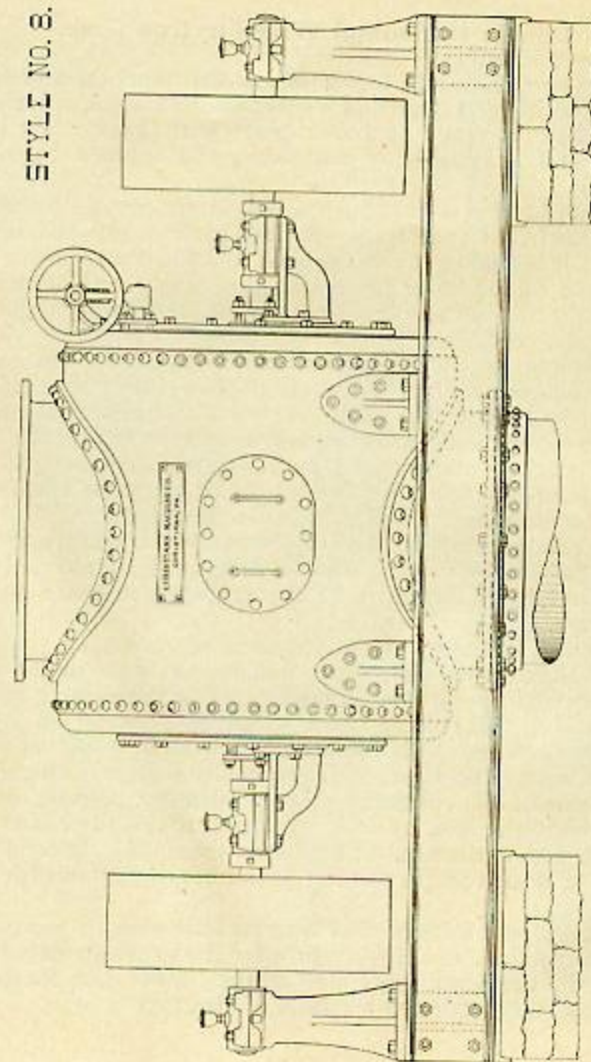
The gate gearing of all wheels of this class, while differing from that of the vertical wheels, is equally simple and efficient, and by it the gates of the largest wheels are moved with ease.

It is well suited for the attachment of a governor.

The illustration shows the machine in its simplest form with the shaft projecting at either end for receiving a pulley or coupling. It stands on a broad base flange on a well supported floor. The floor timbers should be suitably framed under the base, and through the floor is cut a hole of the size of the connecting flange on the draft tube, which is bolted to the base by bolts passing through the inside line of holes seen therein. The base, extending beyond the flange of draft tube, is secured to the floor by an outside line of bolts.

The compact form of this twin turbine with its simplicity of construction, enables us to offer the greatest amount of power in the least space and at the lowest cost consistent with a well constructed machine of this type.

STYLE NO. 8.



DOUBLE HORIZONTAL WHEEL IN IRON CASE WITH EXTENDED SHAFT, PULLEYS AND OUTSIDE BEARING.

STYLE No. 8.**Double Horizontal Wheel in Iron Case With Extended Shaft, Pulleys and Outside Bearings.**

The outline view, on opposite page, illustrates a modification of the preceding style of machine. It is designed for very heavy service. The case, instead of standing on a base, is supported by brackets on heavy I beams, which also furnish support to the pedestals placed outside the pulleys.

The foundation walls should be laid up in hydraulic cement and capped with a wall plate on which the I beams should rest.

The arrangement may be modified as conditions require and one or both ends of the shaft used for transmitting the power.

Large power plants for manufacturing, electric lighting, electric power transmission or other purpose where it is desirable to impart motion to a horizontal line, without the use of bevel gearing, generally require wheels of this class.

Estimates of cost will be given to those furnishing us with the requirements of the situation.

SPECIAL INFORMATION.

To be Given in Ordering.

Parties ordering wheels of the style No. 7 or No 8, should state whether the connection for supply pipe should be on one side, on top, or at some angle between these positions, giving the angle, either in degrees from a horizontal line, or in the amount of fall per foot of horizontal measurement.

Also state which way the wheels are to run—whether the tops of them are to turn toward the inlet or from it.

While they are so made as to be put together to run either way, it may save time and work to have them leave the shop in the position required for use.

The gate gearing is always placed as shown in the cuts, unless otherwise ordered.

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

SIZE OF WHEELS.	Horse-p'w'r Water Used, Revolutions.	HEADS IN FEET.										
		4	5	6	7	8	9	10	11	12	13	
6	H. P.	.23	.33	.43	.52	.65	.79	.92	1.07	1.22	1.38	
	C. F.	38	43	47	51	54	58	61	64	67	69	
	Rev.	305	415	490	539	565	600	639	665	685	725	
8	H. P.	.12	.58	.76	.97	1.18	1.41	1.65	1.92	2.17	2.41	
	C. F.	69	77	84	91	97	103	109	114	119	124	
	Rev.	302	338	371	409	425	451	477	500	525	544	
10	H. P.	.65	.92	1.22	1.53	1.86	2.22	2.60	2.99	3.41	3.86	
	C. F.	108	124	133	145	153	162	171	179	188	195	
	Rev.	343	273	300	325	344	364	385	405	425	440	
12	H. P.	.96	1.33	1.75	2.20	2.70	3.21	3.76	4.34	4.95	5.57	
	C. F.	156	175	191	205	221	234	247	259	270	281	
	Rev.	361	226	249	269	286	301	321	338	352	365	
14	H. P.	1.30	1.81	2.39	3.01	3.68	4.39	5.13	5.91	6.74	7.60	
	C. F.	213	238	261	281	301	320	337	353	369	384	
	Rev.	171	195	215	232	246	261	276	290	303	315	
16	H. P.	1.70	2.38	3.13	3.93	4.80	5.74	6.72	7.74	8.84	9.95	
	C. F.	279	312	342	369	394	418	441	462	484	503	
	Rev.	163	171	188	203	216	229	242	253	265	276	
18	H. P.	2.16	3.02	3.96	5.00	6.10	7.28	8.53	9.83	11.21	12.63	
	C. F.	351	395	434	468	501	531	560	587	612	638	
	Rev.	137	153	168	181	195	205	216	226	236	246	
21	H. P.	2.91	4.11	5.41	6.80	8.31	9.94	11.58	13.44	15.11	17.27	
	C. F.	483	549	602	639	681	725	765	802	838	872	
	Rev.	118	132	145	155	165	175	185	194	203	212	
24	H. P.	3.84	5.40	7.08	8.93	10.92	13.03	15.26	17.60	20.15	22.62	
	C. F.	633	708	775	828	886	951	1002	1051	1098	1142	
	Rev.	103	115	126	136	145	154	162	170	178	185	
27	H. P.	4.88	6.84	9.00	11.36	13.83	16.52	19.33	22.33	25.43	28.71	
	C. F.	833	897	984	1064	1135	1205	1269	1332	1391	1450	
	Rev.	92	103	113	122	130	138	145	152	159	166	
30	H. P.	6.05	8.47	11.13	14.01	17.30	20.41	23.94	27.63	31.47	35.79	
	C. F.	991	1111	1218	1315	1407	1491	1572	1649	1722	1792	
	Rev.	83	95	102	110	117	124	131	138	144	150	
33	H. P.	7.34	10.27	13.50	17.09	20.79	24.75	28.65	33.51	38.16	43.03	
	C. F.	1205	1348	1477	1595	1706	1809	1907	2000	2088	2173	
	Rev.	75	84	93	100	106	113	119	125	131	136	
36	H. P.	8.75	12.25	16.08	20.30	24.78	29.45	34.62	39.92	45.47	51.21	
	C. F.	1437	1606	1760	1900	2034	2155	2273	2383	2488	2586	
	Rev.	69	77	85	92	98	103	109	115	120	125	
42	H. P.	12.00	16.75	22.01	27.75	33.91	40.44	47.40	54.62	62.26	70.02	
	C. F.	1965	2197	2405	2600	2783	2950	3112	3262	3402	3536	
	Rev.	60	67	73	79	84	89	94	99	104	108	
48	H. P.	15.79	22.00	28.93	36.45	44.47	53.13	62.30	71.78	81.70	92.00	
	C. F.	2682	2881	3160	3419	3655	3880	4088	4288	4480	4647	
	Rev.	52	59	64	69	74	79	83	87	91	95	
54	H. P.	19.82	28.03	36.77	46.39	56.70	67.55	79.10	91.31	104.1	117.5	
	C. F.	3287	3675	4021	4348	4647	4928	5190	5450	5690	5920	
	Rev.	47	52	55	62	66	70	74	78	82	85	
60	H. P.	24.83	34.57	45.40	57.47	70.29	84.73	98.16	113.2	129.0	145.5	
	C. F.	4075	4644	4963	5391	5768	6112	6445	6760	7060	7347	
	Rev.	43	48	52	56	60	64	68	71	74	77	
66	H. P.	30.17	42.15	55.47	69.90	86.29	102.7	120.5	139.1	158.4	178.6	
	C. F.	4954	5640	6072	6555	7011	7435	7835	8220	8581	8930	
	Rev.	39	43	47	51	54	58	62	65	68	71	
72	H. P.	36.43	50.92	66.96	84.43	103.1	123.9	144.9	166.1	189.2	213.1	
	C. F.	5929	6629	7254	7837	8380	8880	9364	9817	10255	10654	
	Rev.	36	40	44	47	51	54	57	60	62	64	

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

SIZE OF WHEELS.	Horse-pwr of Water Used, Revolutions.	HEADS IN FEET.										
		14	15	16	17	18	19	20	21	22	23	
6	H. P.	1.54	1.70	1.86	2.05	2.22	2.43	2.62	2.81	3.01	3.22	
	C. F.	72	74	76	79	82	84	86	88	90	92	
	Rev.	750	770	790	815	840	865	890	915	940	960	
8	H. P.	2.76	3.01	3.36	3.68	4.00	4.34	4.70	5.05	5.43	5.82	
	C. F.	120	133	138	142	146	150	154	158	162	166	
	Rev.	664	584	604	622	640	658	676	693	710	726	
10	H. P.	4.31	4.80	5.28	5.78	6.31	6.79	7.37	7.93	8.51	9.11	
	C. F.	202	210	217	223	230	236	242	248	254	260	
	Rev.	456	471	486	501	516	531	546	560	574	587	
12	H. P.	6.21	6.90	7.66	8.34	9.07	9.84	10.67	11.45	12.27	13.13	
	C. F.	292	302	312	322	331	340	350	358	366	375	
	Rev.	380	393	406	418	430	441	452	464	476	487	
14	H. P.	8.52	9.44	10.38	11.43	12.40	13.46	14.54	15.64	16.76	17.89	
	C. F.	399	413	426	440	452	465	477	489	500	511	
	Rev.	326	337	348	359	370	380	390	400	410	420	
16	H. P.	11.13	12.35	13.60	14.88	16.23	17.60	19.02	20.47	21.93	23.47	
	C. F.	522	540	558	575	592	608	624	640	655	670	
	Rev.	286	296	306	315	324	333	342	351	360	368	
18	H. P.	14.14	15.67	17.27	18.92	20.60	22.34	24.14	26.00	27.85	29.75	
	C. F.	603	626	648	670	691	712	732	752	771	791	
	Rev.	256	265	274	282	290	298	306	314	322	329	
21	H. P.	19.28	21.40	23.58	25.83	28.15	30.55	32.96	35.50	38.10	40.70	
	C. F.	905	936	967	997	1026	1054	1081	1108	1135	1160	
	Rev.	230	228	226	223	220	217	214	211	208	204	
24	H. P.	25.30	28.05	31.85	35.85	39.89	44.00	48.16	52.45	56.85	61.26	
	C. F.	1185	1235	1287	1340	1394	1448	1502	1556	1610	1664	
	Rev.	192	199	206	212	218	224	230	236	242	247	
27	H. P.	32.22	35.73	39.28	43.10	46.92	50.84	54.90	59.08	63.41	67.83	
	C. F.	1505	1568	1636	1705	1775	1846	1918	1990	2062	2134	
	Rev.	172	178	184	190	195	200	205	210	215	220	
30	H. P.	39.94	44.28	48.78	53.45	58.37	63.15	68.16	73.35	78.68	84.10	
	C. F.	1860	1925	1988	2050	2109	2167	2222	2278	2332	2384	
	Rev.	156	161	166	171	176	181	186	190	194	198	
33	H. P.	48.33	53.62	58.87	64.70	70.48	76.43	82.33	88.31	94.35	101.8	
	C. F.	2265	2335	2410	2486	2568	2646	2724	2802	2878	2952	
	Rev.	141	146	150	155	160	164	169	173	177	181	
36	H. P.	57.87	63.97	70.71	77.40	84.32	91.50	98.80	106.2	114.0	121.8	
	C. F.	2687	2780	2874	2960	3045	3130	3212	3292	3370	3448	
	Rev.	130	134	138	142	147	151	155	158	162	166	
42	H. P.	79.13	87.80	96.74	106.0	115.4	125.2	135.2	145.4	155.9	166.7	
	C. F.	3673	3805	3939	4073	4211	4353	4495	4637	4779	4921	
	Rev.	112	116	120	124	128	131	134	137	140	143	
48	H. P.	104.0	115.3	127.1	139.4	151.1	163.5	177.1	191.1	205.6	219.1	
	C. F.	4830	4998	5164	5329	5499	5660	5828	5996	6168	6334	
	Rev.	99	102	105	109	112	115	118	121	124	126	
54	H. P.	132.5	147.0	161.8	177.3	193.1	209.2	226.1	243.1	260.2	278.7	
	C. F.	6455	6671	6874	7078	7273	7470	7668	7868	8068	8268	
	Rev.	88	91	94	97	100	102	104	107	110	112	
60	H. P.	164.2	182.1	200.6	219.8	239.4	259.6	280.2	301.7	323.5	345.5	
	C. F.	7625	7892	8150	8405	8646	8884	9109	9340	9560	9772	
	Rev.	80	83	85	88	91	94	96	98	100	102	
66	H. P.	193.6	221.4	243.8	267.2	291.1	315.7	340.9	366.8	393.3	420.5	
	C. F.	9267	9595	9908	10218	10512	10800	11080	11355	11622	11886	
	Rev.	73	75	77	80	82	84	86	88	90	92	
72	H. P.	238.4	264.3	291.4	318.9	347.4	376.9	407.4	438.1	469.9	502.0	
	C. F.	11070	11453	11840	12235	12645	13060	13480	13905	14335	14765	
	Rev.	67	70	72	74	76	78	80	82	84	86	

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

SIZE OF WHEELS.	Horse-power, Water Used, Revolutions.	HEADS IN FEET.									
		24	25	26	27	28	29	30	31	32	
6	H.-P.	3.44	3.66	3.88	4.11	4.33	4.60	4.84	5.10	5.31	
	C. F.	94	96	98	100	102	104	106	108	109	
	Rev.	280	1000	1020	1040	1060	1080	1100	1115	1120	
8	H.-P.	6.18	6.58	6.97	7.36	7.76	8.17	8.64	9.07	9.51	
	C. F.	169	173	176	179	182	185	189	192	195	
	Rev.	742	757	772	786	800	813	826	838	850	
10	H.-P.	9.72	10.31	10.93	11.56	12.20	12.86	13.53	14.23	14.92	
	C. F.	266	271	276	281	286	291	296	301	306	
	Rev.	600	612	624	635	646	657	668	678	688	
12	H.-P.	14.00	14.90	15.77	16.71	17.63	18.56	19.52	20.55	21.56	
	C. F.	383	391	398	406	413	420	427	435	442	
	Rev.	498	508	518	528	538	547	556	564	572	
14	H.-P.	19.00	20.34	21.65	22.76	24.03	25.32	26.66	28.02	29.41	
	C. F.	522	534	543	553	563	572	583	593	604	
	Rev.	430	439	448	456	464	471	478	486	492	
16	H.-P.	25.02	26.68	28.29	29.80	31.50	33.20	34.94	36.67	38.48	
	C. F.	684	699	711	724	738	751	764	776	789	
	Rev.	376	384	392	399	406	413	420	426	432	
18	H.-P.	31.75	33.76	35.70	37.86	39.95	42.13	44.36	46.59	48.88	
	C. F.	868	886	903	920	936	953	970	986	1002	
	Rev.	336	345	350	356	362	368	374	380	386	
21	H.-P.	43.35	46.07	48.83	51.65	54.55	57.55	60.55	63.60	66.73	
	C. F.	1185	1209	1232	1255	1278	1302	1324	1346	1368	
	Rev.	200	205	200	205	210	215	220	225	230	
24	H.-P.	56.85	60.40	64.10	67.78	71.60	75.45	79.40	83.44	87.54	
	C. F.	1552	1580	1615	1645	1676	1705	1735	1764	1793	
	Rev.	232	237	242	247	252	257	262	266	270	
27	H.-P.	72.22	76.05	81.61	86.40	91.15	96.00	100.9	105.9	111.0	
	C. F.	1968	2013	2053	2093	2129	2165	2200	2235	2270	
	Rev.	225	230	235	240	244	248	252	256	260	
30	H.-P.	89.66	95.32	101.1	106.9	112.9	119.0	125.3	131.5	138.1	
	C. F.	2436	2486	2535	2583	2630	2677	2723	2768	2814	
	Rev.	203	208	212	216	220	223	227	231	234	
33	H.-P.	109.0	115.9	123.0	130.1	137.4	144.8	152.4	160.1	167.9	
	C. F.	2854	2915	2975	3033	3090	3147	3202	3257	3312	
	Rev.	184	188	192	196	200	203	206	210	213	
36	H.-P.	130.0	138.1	146.6	155.1	163.7	172.6	181.7	190.9	200.2	
	C. F.	3520	3592	3666	3735	3806	3879	3948	4003	4068	
	Rev.	179	174	178	181	184	187	190	193	196	
42	H.-P.	177.8	189.1	200.5	212.1	224.0	236.4	248.6	261.2	274.1	
	C. F.	4815	4916	5014	5107	5200	5295	5388	5477	5567	
	Rev.	146	149	152	155	158	161	164	166	168	
48	H.-P.	233.8	248.5	263.5	278.7	294.5	310.3	326.6	343.2	359.9	
	C. F.	6332	6492	6589	6711	6838	6966	7078	7197	7310	
	Rev.	128	131	134	136	138	141	144	146	148	
54	H.-P.	297.2	315.8	335.0	354.6	374.6	394.6	415.3	436.4	457.6	
	C. F.	8019	8212	8370	8538	8696	8846	8998	9150	9305	
	Rev.	114	117	120	122	124	126	128	130	132	
60	H.-P.	368.7	392.0	415.7	439.8	464.4	489.6	515.2	541.2	567.9	
	C. F.	9887	10102	10293	10589	10782	10975	11163	11348	11537	
	Rev.	104	106	108	110	112	114	116	118	120	
66	H.-P.	418.4	446.5	475.5	504.8	534.7	565.5	596.2	627.9	660.3	
	C. F.	12145	12391	12628	12875	13111	13344	13571	13796	14023	
	Rev.	94	96	98	100	102	104	106	107	108	
72	H.-P.	535.7	569.1	601.4	638.1	675.0	711.1	748.8	786.5	825.1	
	C. F.	14508	14798	15103	15387	15674	15940	16224	16492	16760	
	Rev.	88	90	92	93	94	96	98	100	102	

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

Size of Wheels.	Horse-power, Water Used, Revolutions.	HEADS IN FEET.								
		33	34	35	36	37	38	39	40	41
6	H. P.	5.60	5.87	6.10	6.38	6.65	6.90	7.20	7.45	7.70
	C. F.	111	113	114	116	118	119	121	122	123
	Rev.	1150	1170	1185	1200	1215	1229	1245	1260	1280
8	H. P.	10.00	10.45	10.90	11.40	11.80	12.30	12.80	13.33	13.85
	C. F.	198	201	204	207	209	212	215	218	221
	Rev.	863	876	889	902	915	928	941	954	966
10	H. P.	15.70	16.42	17.15	17.90	18.65	19.40	20.20	20.95	21.72
	C. F.	311	316	321	325	330	334	339	343	347
	Rev.	698	708	718	728	739	750	760	770	780
12	H. P.	22.38	23.65	24.70	25.77	26.85	27.90	29.00	30.20	31.30
	C. F.	448	453	462	469	475	481	487	494	500
	Rev.	581	590	599	608	617	626	634	642	651
14	H. P.	30.87	32.25	33.65	35.10	36.00	38.15	39.65	41.15	42.65
	C. F.	612	621	630	639	648	657	666	674	682
	Rev.	500	508	515	522	530	538	545	552	559
16	H. P.	40.35	42.20	44.05	46.00	48.00	49.90	52.20	53.90	55.77
	C. F.	801	813	825	837	849	860	871	883	894
	Rev.	439	446	452	458	465	472	478	484	490
18	H. P.	51.28	53.55	55.55	58.35	60.80	63.25	65.80	68.40	70.90
	C. F.	1018	1032	1047	1062	1077	1091	1105	1120	1134
	Rev.	392	398	404	410	416	422	427	432	437
21	H. P.	70.00	73.10	76.15	79.70	83.15	86.60	90.05	93.45	97.00
	C. F.	1389	1400	1430	1450	1471	1491	1511	1530	1549
	Rev.	335	340	345	350	355	360	365	370	375
24	H. P.	91.70	95.90	100.2	104.5	108.9	113.2	117.8	122.4	127.0
	C. F.	1829	1847	1874	1902	1927	1953	1978	2004	2030
	Rev.	235	240	244	248	252	256	260	264	268
27	H. P.	116.1	121.6	127.1	132.6	138.1	143.8	149.6	155.2	161.1
	C. F.	2308	2340	2375	2410	2442	2475	2508	2538	2570
	Rev.	264	268	272	275	279	283	287	290	294
30	H. P.	144.6	151.1	157.8	164.5	171.6	178.5	185.7	192.9	200.2
	C. F.	2856	2898	2941	2982	3024	3064	3105	3144	3184
	Rev.	238	242	245	248	252	256	259	262	265
33	H. P.	175.8	183.8	192.1	200.4	208.8	217.2	225.9	234.7	243.5
	C. F.	3463	3515	3567	3618	3668	3716	3766	3814	3861
	Rev.	217	220	223	226	229	232	235	238	241
36	H. P.	200.8	210.1	219.8	229.6	239.5	249.9	260.1	270.7	280.3
	C. F.	4132	4190	4250	4310	4373	4429	4486	4546	4606
	Rev.	190	202	214	226	239	252	265	278	291
42	H. P.	286.9	300.0	313.4	326.8	340.8	354.7	369.0	383.0	397.3
	C. F.	5652	5734	5820	5901	5987	6068	6149	6224	6299
	Rev.	171	174	176	178	181	184	186	188	190
48	H. P.	376.9	394.1	411.6	429.8	447.5	465.8	484.2	503.1	522.4
	C. F.	7425	7535	7645	7760	7872	7982	8070	8176	8282
	Rev.	151	154	156	158	160	162	164	166	168
54	H. P.	479.2	500.5	523.0	545.8	568.5	591.8	615.4	638.7	662.9
	C. F.	9439	9570	9711	9856	9997	10123	10257	10380	10510
	Rev.	134	136	138	140	142	144	146	148	151
60	H. P.	591.5	621.4	649.2	677.0	705.6	734.4	763.8	793.2	823.2
	C. F.	11710	11881	12057	12235	12396	12562	12730	12890	13053
	Rev.	122	124	126	128	130	132	134	136	137
66	H. P.	722.6	755.6	789.3	823.5	858.0	892.8	928.6	964.3	1000.9
	C. F.	14233	14445	14658	14870	15073	15272	15477	15671	15868
	Rev.	110	112	114	116	118	120	122	124	125
72	H. P.	864.2	901.0	942.8	983.6	1023.5	1066.7	1108.9	1152.5	1196.2
	C. F.	17023	17262	17510	17760	18016	18247	18482	18729	18964
	Rev.	104	105	107	108	110	112	113	114	116

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

SIZE OF WHEELS.	Horse-power, Water Used, Revolutions.	HEADS IN FEET.								
		42	43	44	45	46	47	48	49	50
6	H. P.	8.03	8.25	8.51	8.87	9.21	9.48	9.83	10.11	10.47
	C. F.	125	127	128	129	131	132	134	135	137
	Rev.	1309	1315	1330	1345	1360	1375	1390	1405	1420
8	H. P.	14.32	14.86	15.31	15.89	16.45	16.96	17.54	18.05	18.65
	C. F.	223	226	228	231	234	236	239	241	244
	Rev.	978	989	1000	1013	1025	1036	1046	1056	1065
10	H. P.	22.54	23.34	24.15	24.97	25.80	26.73	27.60	28.40	29.28
	C. F.	351	355	359	363	367	372	376	379	383
	Rev.	799	800	810	820	830	838	846	854	862
12	H. P.	32.50	33.66	34.85	36.05	37.27	38.52	39.70	40.98	42.30
	C. F.	505	512	518	524	530	536	541	547	552
	Rev.	660	668	676	684	692	698	704	710	716
14	H. P.	44.31	45.95	47.59	49.12	50.85	52.55	54.25	55.89	57.70
	C. F.	690	699	706	714	723	731	739	746	754
	Rev.	566	573	580	587	594	600	606	611	616
16	H. P.	58.05	60.16	62.23	64.40	66.25	68.77	71.05	73.27	75.45
	C. F.	901	915	925	936	942	957	968	978	987
	Rev.	495	501	506	513	519	525	530	535	540
18	H. P.	73.66	76.33	79.00	81.67	84.47	87.24	90.05	92.90	96.00
	C. F.	1147	1161	1174	1187	1201	1214	1227	1240	1253
	Rev.	442	447	452	457	462	467	472	476	480
21	H. P.	103.6	104.3	107.3	111.6	115.3	119.1	123.0	126.8	131.0
	C. F.	1567	1586	1604	1622	1640	1658	1676	1693	1710
	Rev.	380	384	388	393	398	402	406	410	414
24	H. P.	131.8	136.6	141.4	146.2	151.1	156.1	161.2	166.2	172.0
	C. F.	2053	2078	2102	2125	2149	2172	2195	2219	2241
	Rev.	332	336	340	344	348	352	356	360	363
27	H. P.	167.1	173.2	179.3	185.4	191.5	197.7	204.2	210.5	217.4
	C. F.	2502	2534	2565	2595	2625	2652	2682	2710	2740
	Rev.	298	301	304	308	312	315	318	321	324
30	H. P.	207.5	215.0	222.5	230.2	237.9	245.6	253.5	261.5	269.5
	C. F.	3222	3290	3358	3425	3492	3558	3624	3689	3755
	Rev.	268	271	275	278	281	284	287	290	293
33	H. P.	252.5	261.5	270.7	280.0	289.4	298.9	308.4	318.2	327.9
	C. F.	3908	3951	4000	4045	4090	4134	4177	4221	4263
	Rev.	241	247	250	253	256	259	261	264	266
36	H. P.	303.8	311.8	322.6	338.2	345.1	356.3	367.4	379.5	391.3
	C. F.	4656	4713	4766	4819	4876	4928	4976	5034	5087
	Rev.	223	226	229	232	234	237	239	242	244
42	H. P.	411.9	427.0	441.5	456.9	472.3	487.8	503.8	519.4	535.3
	C. F.	6355	6455	6524	6600	6674	6747	6819	6890	6958
	Rev.	192	195	198	200	203	205	208	210	213
48	H. P.	541.2	569.8	589.5	609.2	629.4	649.7	669.6	689.4	709.3
	C. F.	8576	8478	8576	8670	8767	8861	8950	9053	9143
	Rev.	169	172	174	176	178	180	182	184	186
54	H. P.	687.0	712.6	737.8	763.1	788.1	813.9	840.5	866.4	893.4
	C. F.	10372	10772	10900	11022	11136	11256	11380	11493	11615
	Rev.	153	155	156	158	159	161	162	164	165
60	H. P.	833.5	884.1	915.2	946.6	978.4	1010.3	1042.7	1075.5	1108.4
	C. F.	13299	13565	13521	13673	13825	13972	14120	14267	14410
	Rev.	138	139	140	142	143	145	146	148	149
66	H. P.	1037.8	1075.0	1112.8	1150.8	1189.6	1228.5	1267.5	1307.7	1347.7
	C. F.	16061	16250	16440	16623	16810	16990	17163	17347	17520
	Rev.	126	127	128	130	131	133	134	136	137
72	H. P.	1259.4	1284.5	1329.1	1374.5	1421.7	1468.0	1515.0	1563.5	1612.1
	C. F.	19182	19417	19635	19854	20080	20303	20511	20740	20958
	Rev.	118	119	120	121	122	123	124	125	126

TABLE No. 6.

Giving the Horse-power of Wheels, the Cubic Feet of Water Used and Number of Revolutions per Minute, under the given Heads.

SIZE OF WHEELS.	Horse-Power.	Water Used.	Revolutions.	HEADS IN FEET.												
				52	54	56	58	60	62	64	66	68	70	72	74	76
6	H.-P.	11.95	11.75	12.35	13.05	13.76	14.40	15.17	15.85	16.63	17.35	18.05	18.90	19.65		
	C. F.	139	142	144	147	150	152	155	157	160	162	164	167	169		
	Rev.	1460	1475	1500	1520	1540	1560	1580	1605	1630	1655	1680	1705	1730		
8	H.-P.	19.72	20.90	22.30	23.23	24.40	25.70	27.00	28.25	29.53	30.82	32.25	33.60	35.00		
	C. F.	248	253	258	262	267	271	276	280	284	288	293	297	301		
	Rev.	1088	1108	1128	1148	1168	1188	1208	1226	1244	1262	1280	1298	1316		
10	H.-P.	31.09	32.86	34.67	36.62	38.53	40.48	42.47	44.40	46.47	48.60	50.64	52.73	54.96		
	C. F.	391	398	405	413	420	427	434	440	447	454	460	466	473		
	Rev.	880	896	912	927	942	957	972	987	1002	1017	1032	1047	1062		
12	H.-P.	44.76	47.40	50.10	52.76	55.41	58.30	61.16	64.08	66.96	70.00	73.00	76.03	79.13		
	C. F.	563	574	585	595	605	615	625	635	644	654	663	672	681		
	Rev.	732	746	760	773	786	799	812	824	836	848	860	871	882		
14	H.-P.	61.11	64.65	68.33	72.00	75.78	79.63	83.47	87.54	91.50	95.47	99.63	103.8	108.1		
	C. F.	709	726	743	760	778	795	812	830	846	862	879	895	911		
	Rev.	630	641	652	663	674	685	696	707	718	729	740	750	760		
16	H.-P.	80.45	84.70	89.48	94.27	99.17	104.2	109.3	114.4	119.6	125.0	130.3	135.9	141.4		
	C. F.	1007	1026	1045	1063	1081	1099	1117	1134	1151	1168	1184	1201	1217		
	Rev.	532	562	572	582	592	602	612	621	630	639	648	657	666		
18	H.-P.	101.5	107.5	113.5	119.6	125.8	132.2	138.5	145.1	151.8	158.5	165.3	172.4	179.5		
	C. F.	1277	1302	1326	1349	1372	1395	1416	1438	1460	1481	1503	1524	1545		
	Rev.	492	502	512	521	530	539	548	556	564	572	580	588	596		
21	H.-P.	138.6	146.8	155.0	163.3	171.8	180.5	189.3	198.3	207.4	216.6	225.9	235.4	245.0		
	C. F.	1744	1778	1810	1842	1873	1904	1935	1965	1995	2024	2052	2081	2108		
	Rev.	424	432	440	448	456	464	472	479	486	493	500	507	514		
24	H.-P.	181.7	192.3	203.0	213.9	224.9	236.3	248.1	259.7	271.7	283.7	295.9	308.3	321.0		
	C. F.	2283	2329	2371	2412	2453	2495	2535	2575	2615	2651	2688	2725	2762		
	Rev.	370	377	384	391	398	405	412	418	424	430	436	442	448		

SIZE OF WHEELS.	Horse-Power.	Water Used.	Revolutions.	HEADS IN FEET.											
				78	80	82	84	86	88	90	92	94	96	98	100
6	H.-P.	20.51	21.29	22.07	22.80	23.67	24.56	25.45	26.30	27.16	28.08	29.00	30.0		
	C. F.	172	174	176	178	180	183	185	187	189	191	193	195		
	Rev.	1755	1780	1805	1830	1855	1880	1900	1920	1940	1960	1980	2000		
8	H.-P.	36.37	37.67	39.23	40.70	42.20	43.70	45.13	46.70	48.30	49.76	51.40	53.2		
	C. F.	295	300	313	317	321	325	328	332	336	339	343	346		
	Rev.	1334	1352	1369	1386	1403	1420	1436	1452	1468	1484	1499	1514		
10	H.-P.	57.12	59.45	61.56	63.83	66.14	68.50	70.87	73.30	75.60	78.10	80.65	83.5		
	C. F.	479	485	491	497	503	509	515	521	526	532	538	543		
	Rev.	1077	1092	1106	1120	1134	1148	1161	1174	1187	1200	1212	1224		
12	H.-P.	82.30	85.63	88.77	91.96	95.33	98.63	102.1	105.5	108.9	112.4	116.0	120.4		
	C. F.	690	700	708	716	725	733	742	750	758	766	774	783		
	Rev.	865	904	916	928	940	952	963	974	985	996	1006	1016		
14	H.-P.	112.3	116.7	121.1	125.6	130.2	134.7	139.3	143.9	148.6	153.4	158.2	164.3		
	C. F.	942	954	966	978	990	1001	1012	1023	1034	1045	1056	1068		
	Rev.	770	780	790	800	810	820	830	840	850	860	869	878		
16	H.-P.	147.0	152.6	158.6	164.4	170.5	176.4	182.3	188.5	194.6	200.9	207.3	215.1		
	C. F.	1233	1249	1265	1280	1296	1311	1325	1340	1354	1369	1383	1398		
	Rev.	675	684	693	702	711	720	728	736	744	752	760	768		
18	H.-P.	186.5	193.7	201.1	208.6	216.1	223.6	231.2	239.0	246.9	254.8	262.8	272.6		
	C. F.	1564	1584	1604	1624	1643	1662	1680	1699	1718	1736	1754	1772		
	Rev.	604	612	620	628	636	644	651	658	665	672	679	686		
21	H.-P.	254.6	264.6	274.6	284.7	295.1	305.5	315.8	326.4	337.1	347.9	358.9	372.0		
	C. F.	2135	2163	2190	2217	2244	2270	2295	2320	2345	2370	2395	2418		
	Rev.	521	528	535	542	549	556	562	568	574	580	585	590		
24	H.-P.	335.1	346.5	358.6	372.9	386.3	400.0	413.5	427.3	441.4	455.6	470.0	485.1		
	C. F.	2797	2833	2868	2903	2938	2972	3005	3038	3071	3104	3136	3166		
	Rev.	454	460	466	472	478	484	489	494	499	504	509	514		

SPECIAL NOTICE.

In ordering Water Wheels, or writing for information concerning them, or gearing of any kind in connection therewith, please give us all the data you can, in order that we may determine what will best suit your case. Give the head of water you have, or vertical distance from surface of water in tail-race to surface of the water in forebay. State as nearly as you can, the size stream you have. It will always be better, if possible, to measure your water by a weir, see page 6, and give the exact number of cubic feet it flows per minute. Tell us whether you have a pond for storing water, and as nearly as you can the area of it. If you are not able to tell just what horse-power you require, tell us how much and what kind of machinery you want to drive. If you want to connect from the vertical shaft on the water wheel to a horizontal shaft, state how fast you want the latter to run, and what the distance is, either from the surface of tail-water or bottom of flume where wheel sets, to the centre of said shaft.

It is generally a good plan to furnish a little sketch to convey your ideas of what you require. This may be simply pencil lines with figures for measurements, if you have not the ability to make anything more elaborate.

 **In ordering Vertical Wheels be careful**
always to state which way your
wheel must run, with or
against the sun. 
With Sun. *Against Sun.*

Apply this rule, also, to Single Horizontal Wheels.

GUARANTEE.

We guarantee The Balanced Gate Turbine to give, under varying heads, the power at which it is tabled, providing it be properly set, and geared to run at tabled speeds. That it has fewer parts and is less complicated than any other wheel made. That the gate will work with absolute ease under all circumstances, and that the ordinary wear from use will have no effect to change it. That the material and workmanship are equal to the best. Any wheel failing to meet this guarantee, may be returned to us if unbroken, and any money that may have been paid on it will be promptly refunded together with all freight charges. But in all cases we must be notified and allowed to make a personal examination before any wheel is returned.

CHRISTIANA MACHINE COMPANY.

TERMS.

This Wheel will be sold and shipped to any person of known responsibility, on 30 days' trial. At the expiration of this time (unless by special arrangement) the bill will be due, and must be paid, unless the wheel does not give satisfaction, in which case it may be returned in accordance with terms of guarantee.

Any person may procure a Wheel on trial as above, by sending us with his order satisfactory reference. Where this cannot be done, it must be paid for on delivery, and collection will be made by draft attached to bill of lading, and sent to any bank or express office most convenient to consignee.

CHRISTIANA MACHINE COMPANY.

PRICE LIST No. 1.

For Wheels Complete as Shown on Page 12.

STYLE No. 1.

	PRICE.	WEIGHT.
10 inch	\$ 95 00	180 lbs.
12 "	100 00	260 "
14 "	110 00	360 "
16 "	120 00	530 "
18 "	135 00	690 "
21 "	155 00	840 "
24 "	175 00	1170 "
27 "	205 00	1540 "
30 "	245 00	1710 "
33 "	285 00	2400 "
36 "	325 00	3100 "
42 "	420 00	4000 "
48 "	530 00	5700 "
54 "	650 00	6800 "
60 "	800 00	8500 "
66 "	1000 00	10,500 "
72 "	1250 00	13,000 "

PRICE LIST No. 2.

For Wheels Complete in Globe Case as Shown on
Page 18.

STYLE No. 2.

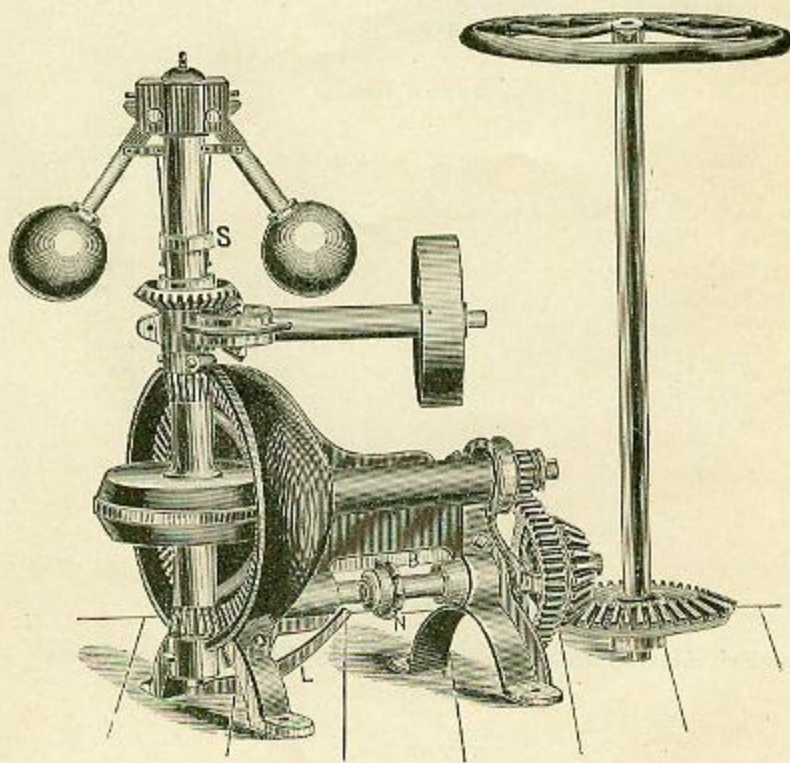
	PRICE.	WEIGHT
6 inch	\$140 00	450 lbs.
8 "	155 00	550 "
10 "	170 00	700 "
12 "	185 00	900 "
14 "	205 00	1076 "
16 "	230 00	1366 "
18 "	270 00	1950 "
21 "	340 00	2900 "
24 "	440 00	4000 "

PRICE LIST No. 3.

For Horizontal Wheels in Globe Case as Shown on
Page 22.

STYLE No. 4.

	PRICE.	WEIGHT.
6 inch	\$180 00	650 lbs.
8 "	200 00	850 "
10 "	220 00	980 "
12 "	240 00	1260 "
14 "	265 00	1500 "
16 "	300 00	1900 "
18 "	350 00	2730 "
21 "	440 00	4060 "
24 "	570 00	5600 "



The New Woodward Friction Water Wheel Governor.

The Balanced Gate Turbine Water Wheel is eminently adapted to the use of a governor owing to the easy movement of the gate.

We furnish the Woodward Governor to those needing such a machine, as being one of the best and cheapest now made. See price list on next page.

Directions for Ordering.

When ordering or writing for information always give the following particulars as far as possible. Neglect to do this will cause more or less delay.

What is the size of water wheel?

Is the gate stem or shaft to which the governor will be geared, upright or horizontal?

How many turns does it make from shut to full open gate?

What diameter is the gate stem?

Does it turn with or against the sun in opening?

Is there any slack in the gate, and if any how much?

What is the size of hand wheel and about how hard does it turn?

What kind and how much machinery will be driven by the wheel?

What is the size and speed of shaft from which the governor will be driven?

Give any other particulars that you think may affect the operation of the governor.

We furnish these governors in four sizes adapting them to any size wheel from the smallest to the largest. The general range for which each size is adapted is given in the following table. This will vary, however, in different cases, and we will be pleased to advise what size governor is best adapted to any case on receipt of the above information.

As shown in the table we can furnish No. 1 and No. 2 governors with fast or slow motion for the driving pulley. We have also increased the motion of pulley in No. 3 and No. 4 sizes. Pulleys of different size from those listed can be furnished when required.

Size No.	To regulate Wheels about	Height inch.	Length.	Width.	Weight.	Shipping weight about.	DRIVING PULLEY.			Price.
							Size.	Quick Speed.	Slow Speed.	
1	50 inch. and over.	36	14	18	285	385	10 x 2½	180 to 205	116 to 130	\$125
	25 inch. to 50 inch.	30	12	14	160	250	8 x 2	200 to 225	120 to 135	100
	15 inch. to 25 inch.	24	10	11	105	160	6 x 1½	270 to 310		75
	15 inch. and under.	20	8	8	60	90	6 x 1¼	300 to 350		50

BASKING RIDGE, N. J., October 27, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Your Turbine Wheel, put in by Mr. O. J. Seibert, Palmyra, Pa., has been running long enough for us to know whether or not it fills the guarantee made by him, and we must say it does in every respect. We are satisfied that it takes as little water as any other wheel can take and do the same amount of work. We are much pleased with the gate; it shuts tight, is easily worked, and the regulation is most excellent; the slightest change in the gate showing in the machinery. The Wheel is 18-inch, under twenty feet head and the mill is forty barrels, and we usually run with one-half gate, which, we think, shows unusually good work for the Wheel. We put in a wheel larger than is required at present, with the expectation of increasing our capacity in the future. It seems to be strong and durable, and the mechanical work is excellent.

In conclusion would say, that if we put in another wheel, which we may do to replace one of our scroll wheels, shall give yours the preference over any other of which we have any knowledge.

Yours very truly,

VAN DORN-SWAIM MILLING COMPANY.

KING'S BRIDGE, PA., September 23, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 24-inch Balanced Gate Turbine Wheel I purchased of you does the work it was represented to do, and I believe gives entire satisfaction.

Yours respectfully,

THOMAS K. PUSEY.

MILLBORO' SPRINGS, VA., 10, 26, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 48-inch Balanced Gate Turbine, bought of you, is giving entire satisfaction. It is driving a thirty-five barrel mill very well under a four foot two inch head. Our full head is six feet, and we can hardly hold it down then. We only use from one-half to two-thirds gate with full head.

Very truly,

JAS. D. LOWMAN.

BELLE HAMPTON, VA., September 28, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Your letter of the nineteenth instant is just received. The 21-inch Balanced Gate Turbine Wheel I bought of you last Spring has given perfect satisfaction.

I have owned two water wheels, one for twenty-five years and the other for half this time. I was a slow convert to the merits of Turbine Wheels, and it was hard to persuade me that a thing so small could have such power; hence, I have been holding on to the old water wheels, and have actually had the wheel built twice to each mill, and one of them was one of the best overshot wheels I ever saw. When this wheel gave out last winter, I yielded to the persuasions of Mr. Robinson, one of your agents, to allow him to put in one of your Turbine Wheels, and my only regret now is that I tried any other kind.

I know nothing of the merits of your wheels as compared with others, but I must say I want nothing better. It seems to have almost a magical power, and a charm in the beauty and smoothness of its running that is wonderful.

Believing me, very truly, etc.,

J. HOGE TYLER, (Ex-Governor).

JONESBORO, VA., July 19, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Yours of the tenth instant to hand and noted. I have just started up the last wheel, which is the third bought of you, and they all give perfect satisfaction. I think they give all the power you claim, and the gate is the best I ever saw; in fact, I don't see where you can make any improvements on it. I think I know a good wheel when I see it.

Yours very truly,

J. H. RYLAND.

HARRISBURG, PA., September 24, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Yours of the nineteenth instant to hand. The 27-inch Balanced Gate Turbine Wheel, which I purchased of you in 1889, is giving entire satisfaction. It has power enough to run three sets of rolls and all the machinery with but very little water. It is one of the best wheels I ever had.

Yours very truly,

J. H. HARTMAN.

SEITZLAND, PA., September 29, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: In October, 1890, I bought of you an 18 inch Balanced Gate Turbine Wheel, which has been running ever since. It gives splendid satisfaction, no trouble with gate, and no waste of water; always tight, and has not caused any attention since it was put in. It runs three stands of rolls and all necessary machinery in the mill; could not expect anything more.

Yours very truly,

O. C. ZEIGLER.

FINCASTLE, VA., August 27, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: I have given the 21-inch Balanced Gate Turbine Wheel a fair trial of thirty days, and am well pleased with it. It runs my thirty-barrel mill at three-quarter gate.

Please accept my thanks for such a good wheel.

Yours very truly,

A. T. HOWELL.

LYNCHBURG, VA., April 22, 1893.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: I have just completed Mr. A. F. Anderson's Mill; it works likes a charm. The 14-inch Wheel, under sixteen foot head, grinds ten bushels of fine meal per hour, and they only use one-half gate on each Wheel to do the work they want.

Mr. A. is much pleased with the working of the Water Wheels and other machinery purchased from you.

Yours very truly,

HARDY & HANCOCK.

ANNAPOLIS, MO., August 11, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 36-inch Wheel I bought of you three years ago is giving entire satisfaction. It runs two sets of bars with cleaning machinery, bolts and corn sheller, under a five foot head. I will cheerfully recommend it to my friends.

I am, sincerely yours,

ED. P. BRNSEN.

MT. JOY, PA., May 1, 1891.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Yours of the nineteenth instant to hand and noted. In reply, your 16-inch Balanced Gate Turbine, put in by Mr. O. J. Seibert, replaced an 18-inch Perfection and Humphrey Wheel. It grinds one-half more than the Perfection and one-third more than the Humphrey, and uses one-third less water than they did.

Truly,

J. M. BRANDT.

FIVE FORKS, VA., July 16, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Yours of July 10 to hand. Am glad to state that your 12-inch Balanced Gate Turbine Wheel gives entire satisfaction; don't think any wheel of its size could do better. It far exceeds the 18-foot overshot I had before I got yours.

Respectfully,

E. L. WOMOCK.

LYNCHBURG, VA., October 15, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: We are using one of your 30-inch Balanced Gate Turbine Wheels with perfect satisfaction, and after four years running are so well pleased with it that we have placed an order with you for a second wheel of the same kind. We are using other wheels, but prefer yours.

Yours very truly,

JOHN H. HEALD & CO.

SMYRNA, PA., September 29, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The 12-inch Balanced Gate Turbine, purchased of you last fall, is giving entire satisfaction; giving more power than I expected. The gate works like a charm, giving no trouble. I will recommend the Wheel to any person wanting a good one.

Truly,

J. F. REED.

WIGHTMAN, VA., May 9, 1890.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: The Messrs. Bagley (and there are four of them interested), think the Balanced Gate Turbine "the best in the world." I heard Mr. C. H. Bagley say to a friend of his, "it is worth its weight in gold."

I promised to grind from six to eight bushels of corn per hour, but I have seen it grind twelve bushels of damp, tough corn per hour, and of good dry corn Mr. B. told me he ground two bushels in nine minutes. I have heard Mr. B. and his miller say they are satisfied that they can do double the work with the same water that they could with the overshot. I hung on both mills at the same time, and the little thing moved off all right, with smut mill and all the machinery for bolting, and Mr. B. said he thought it ground about like the old mill with one pair of stones running. So you can see what they think of it.

Yours truly,

JOSEPH A. PUGH, Millwright.

RUSHVILLE, PA., July 21, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: In regard to the two 30-inch and 36-inch Turbine Wheels, bought of you last fall, I will say that I am satisfied with them. They are all you claim them to be. The gate is perfect, working easy. My little girl, six years old, can open and close it.

The gearing, shafting, etc., gave me satisfaction and cannot be excelled anywhere.

Yours very truly,

F. H. GIFFIN.

FRAZER, PA., July 16, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN: Would say in reply to yours of the tenth instant, that the 16-inch Balanced Gate Turbine Wheel, bought of you in '93, gives satisfaction in every way.

As to its being better than any other wheel, I am not able to say, but think it is equally as good as any made, especially the gate, as there is nothing to get out of order about it.

Yours very truly,

E. P. HERSHEY.

ROXBORO, N. C., May 31, 1894.

Christiana Machine Company, Christiana, Pa.

GENTLEMEN : The 14-inch Balanced Gate Turbine I purchased of you, through Mr. J. J. Hardy, is giving perfect satisfaction.

In the cold weather last winter, ours was the only mill that could grind, and in the dry season last summer it kept grinding when the other mills with overshots were dry.

I can cheerfully recommend the Balanced Gate Turbine Wheel to any parties wanting a good one. The gate is perfectly easy to work.

Yours truly,

JNO. C. PASS.

STYLE NO. 8.

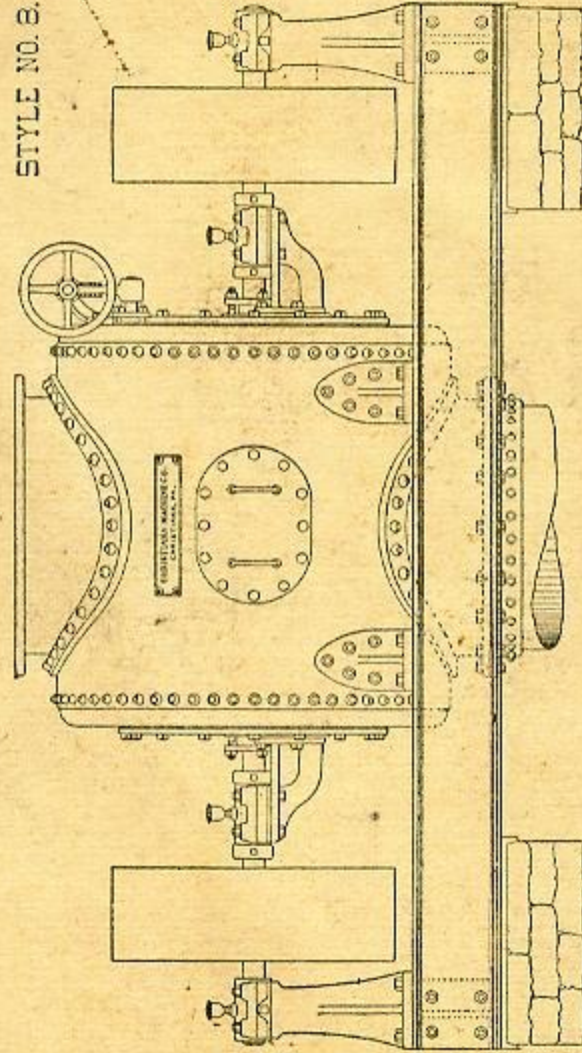
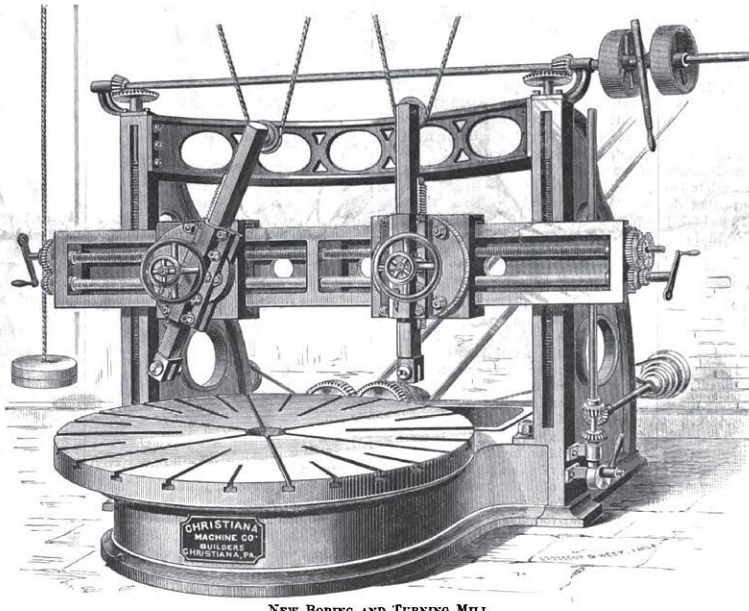


Fig. 16 illustrates the Christiana balanced gate turbine. The feature of this turbine is the self-adjusting balanced gate draft, by which the power to open or close the gate is applied equally at opposite sides. This is accomplished by means of a three-armed piece which rests on the top of the gate ring. Two arms extending to opposite sides of this ring lie between lugs. The third arm is at right angles to the other two arms, and it is to this arm that the moving power is applied and the gate rotated as desired. On the under side of the cap is a sleeve, and on the lower end of this sleeve is a collar with flat surfaces. This collar



Fig. 16.



NEW BORING AND TURNING MILL.

CHRISTIANA MACHINE CO., **CHRISTIANA,**
PENNA.

MANUFACTURERS OF

THE BALANCED GATE TURBINE WHEEL.

SUITABLE FOR LIGHT OR HEAVY SERVICE.

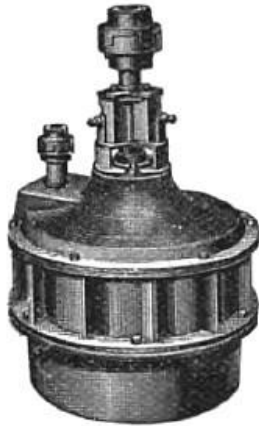
Globe Outer-Cases and Special Wrought or Cast Iron Flumes.

SUITABLE FOR ANY SITUATION.

Gearing of all kinds, Shafting, Pulleys and everything required for a complete Power Plant.

Satisfaction Guaranteed.

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on Application. Send for Catalogue.





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**LEFFEL'S STANDARD, SPECIAL
SAMSON & CASCADE**

UPRIGHT AND HORIZONTAL.

Suitable for all Heads from **3 Feet to 2000 Feet.**
35 Years in the Business.

Designing and building Water Wheels for all purposes and situations. These wheels secure a **High Guaranteed Percentage; Great Steadiness** under variable loads; an **Unequaled Concentration of Power**, and an **Unprecedented High Velocity.** Its quickly operating, balanced gates afford prompt and fine regulation by governor.

Satisfaction Guaranteed where others fail. Write for catalogue of either wheel.

BOILERS AND ENGINES

Upright and Horizontal from 3 Horse-power upwards.

AUTOMATIC AND PLAIN SLIDE VALVE ENGINES.

Send for pamphlet illustrating and describing the Boilers and Engines.

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MANUFACTURERS OF

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Suitable for Light or Heavy Service.

Globe Outer-Cases and Special Wrought or Cast Iron Flumes,

SUITABLE FOR ANY SITUATION.

GEARING of all kinds, **SHAFTING, PULLEYS**, and everything required for complete **POWER PLANT.**

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OF THE VERY HIGHEST STEAMING QUALITIES

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BIG VEIN CUMBERLAND.

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Write for our free catalog No. 306;
tells in detail how you can use water
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Christiana Machine Company
*Specialists in making Hydraulic Turbines,
Cast Tooth Gears, Mortise Gears and
Cut Gears*

Christiana, Pa., U. S. A., Established 1890





ESTABLISHED 1890

CHRISTIANA MACHINE COMPANY
(CHRISTIANA, PENN., U.S.A.)
ENGINEERS, FOUNDERS & MACHINISTS.





TURBINE WATER WHEELS.
ADAPTED TO ALL DUTIES.
POWER TRANSMITTING MACHINERY
GEARING, ROPE WHEELS, FRICTION CLUTCHES,
SHAFTING, PULLEYS, HANGERS, ETC.



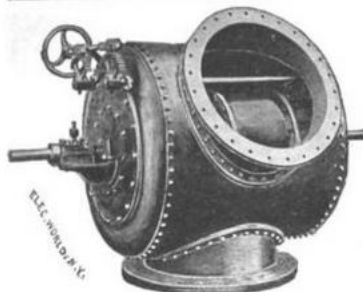


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STYLE No. 7.

Double Horizontal Water Wheel

FOR
**ELECTRIC
LIGHT
AND
POWER
STATIONS.**

The case is made of boiler plate with heavy cast-iron heads, and is capable of sustaining the highest required pressure.

The bearings are provided with automatic oilers. As the end pressure of each wheel is neutralized by that of the other, they run with the least possible amount of friction.

Gate gearing simple and efficient; by it gates of largest wheels are moved with ease.

Well suited for the attachment of a governor.

Greatest amount of power in the least space.

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THE CHRISTIANA MACHINE CO.



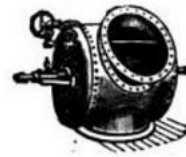
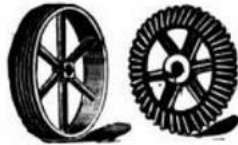
CHRISTIANA MACHINE COMPANY

CHRISTIANA, PA., U. S. A.

Engineers, Founders and Machinists

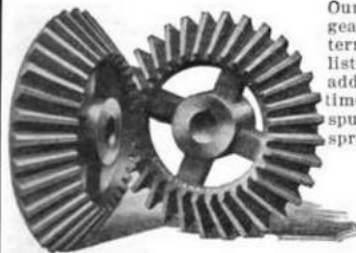
Manufacturers of Turbine Water Wheels, adapted to all duties. Power Transmitting Machinery, Gearing, Rope Wheels, Friction Clutches, Shafting, Pulleys, Hangers, etc.
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ENGINEERS, FOUNDERS AND MACHINISTS,

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Power Transmitting Machinery.

Gearing, Rope Wheels, Friction Clutches, Shafting, Pulleys, Hangers, Etc.

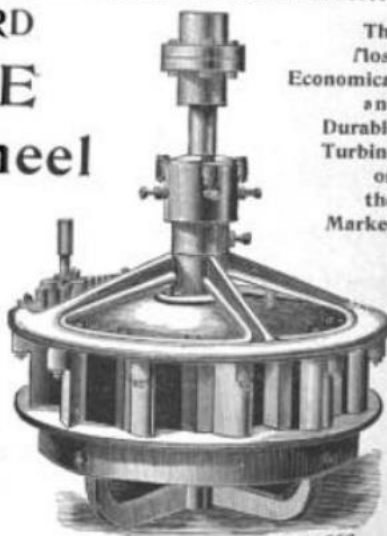
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Embodying Best Material and
Mechanical Skill, and
Producing Most Power with
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Economical
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GOOD design, high-grade materials and careful manufacture are the distinguishing features of C. M. C. Vertical and Horizontal Turbines. We have been making them for more than fifty years. During that time we have studied their operation in actual use and have incorporated in their design every worth while improvement that experience could recommend. Christiana Turbines are accepted as the standard machine for utilizing water power.

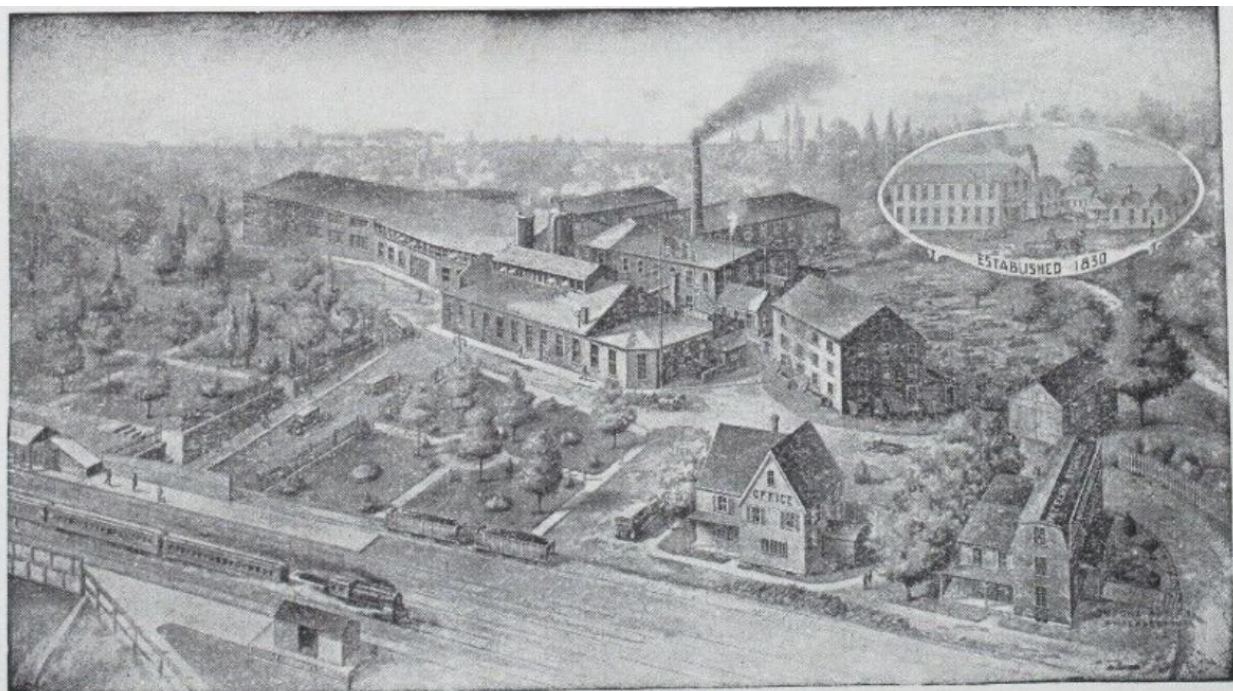
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